

HISTORY OF MEDICINE

MAX NEUBURGER

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HISTORY OF MEDICINE

History of Medicine

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P R E F A C E

WITHIN the past twenty years there has been a remarkable revival of interest in the history of medicine. Chairs or lectureships have been established in Continental, English and American Universities ; Societies and Clubs devoted to the study of the subject have been started ; instead of one there are now three or four Journals, and the literature has been enriched with innumerable monographs and articles. A comparison of a volume of the *Index Medicus* for ten or twelve years ago with a recent one, shows how actively medicine is participating in the study of origins, and how much as a profession we are being influenced by modern historical methods.

The subject has three relations. For the student the educational aspect is of incalculable value, since medicine is best taught from the evolutionary standpoint. What a help it is to give early in his career a clear view of the steps by which our present knowledge has been reached ! And yet in the present crowded state of the curriculum, it seems very undesirable to make the history of medicine a compulsory subject. As I remarked some years ago : “ An attractive course will catch the good men and do them good, but much more valuable is it to train the mind of the student to look at things from the historical standpoint, and this can be done by individual teachers who themselves appreciate the truth of Fuller’s remark, ‘ That history maketh a young man to be old without either wrinkles or grey hairs ; privileging him with the experience of age without either the infirmities or inconveniences thereof. Yea, it not only maketh things past present, but enableth one to make a rational conjecture of things to come. For this world affordeth no new accidents, but in the same sense wherein we call it a *new moon*, which is the old one in another shape ; and yet no other than that hath been formerly. Old actions return again, furbished over with some new and different circumstances ’ ” (*B. M. J.* 1902).

Secondly, as a study, the history of that branch of science which has to do with healing has peculiar attractions. With foundations in anthropology medicine has close affiliations with most of the theologies, many of the philosophies, and with the pseudo-sciences of alchemy and astrology. To trace its gradual evolution, to study the relations which it has borne to the intellectual movements at different periods, is the work of scholars trained in modern methods of research. Unfortunately in this utilitarian age men of the stamp of Friend, Sprengel, Littré, Haesser, Daremberg, Adams and Greenhill are rare—men who are not only able to discover facts, but who have historical insight enough to recognise their significance. The truth is that scholars, the archivists and “back-stairs men,” as they have been called, need encouragement from the Medical Faculties of our universities. There is not in this country a single chair of the history of medicine! The Fitzpatrick Foundation (1901) at the Royal College of Physicians has been the medium of several important lecture courses, and has brought out the valuable study by Dr. J. F. Payne, of English medicine in the Anglo-Saxon period. But unfortunately men with the necessary taste and scholarship, and there are not a few in this country, soon have their energies diverted to other fields. By far the most active group of scholars is in Germany, where two great works have been undertaken of the very first importance in the history of medicine. Under the auspices of the Imperial Academy of Berlin, Trübner & Co. of Leipzig will publish a new text of the Greek writers in medicine. As a preparation for this great work, distinguished scholars, under the direction of Professor Diehl, have inspected and collated all the important MSS. in the libraries of Europe. A topographical list has been issued with reference to all the sources of our knowledge of Hippocratic and later Greek writers. It is impossible to overestimate the value of the work already done. But more important in stimulating interest in the subject has been the foundation of an Institute for the study of the history of medicine at the University of Leipzig as a memorial to the distinguished scholar, the late Professor Puschmann. Under the direction of Professor Sudhoff, the Institute will undertake an entirely new edition of the Latin authors. The output in Germany of works and monographs, representing scholarship of the first class, is equal to the rest of the world put together; and in making this statement I do not overlook the fact that the French school of

medical historians has always occupied a most distinguished position, and the subject is one which has for generations received encouragement from the universities in France.

Even more striking has been the growth of the subject in its third relation—a useful pastime for the leisure moments of busy men who take an interest in the history of the profession, local or general. Both in England and the United States this has tended more towards the biographical side of medical history, and many valuable monographs have been published. While not always work of the first class it has stimulated interest and furnished many delightful and instructive stories of the heroes of medicine. It is a great pity that the *Masters of Medicine Series*, published by Smith, Elder, & Co., could not have been kept up. The lives of Sydenham by Payne, of Harvey by Power, of Hunter by Paget, are models of accurate and informing biography. Much that is best in the history of medicine may in this way be portrayed, and indeed from the intimate records of many an old physician or surgeon side-lights are thrown on the manners and customs of the period. The story of the life of Georges Mareschal, surgeon to Louis XIV., as told by his descendant (*Paris*), gives as vivid a picture of the court life of the period as may be gleaned from the pages of St. Simon.

A valuable outcome of the awakened interest in the subject has been the growth of medical libraries in different centres, and the collection of documents, pictures, etc., illustrating the local history of the profession.

Only a few important works dealing with the subject in a systematic manner have been published within this period. Gurlt's "Geschichte der Chirurgie" is a monumental contribution. The *Handbuch der Geschichte der Medizin*, designed by Puschmann and edited by Neuburger and Pagel, is invaluable as a work of reference. A history of medicine suitable for the student and general reader is a difficult book to write. Few men have the necessary qualifications for the task. The special scholar with knowledge of great fullness and accuracy in one period may be the very last man to undertake a work in which proportion is the essential element. When Fasciculus I. of Neuburger's *Geschichte der Medizin* came to hand I felt that here was a book which would be particularly useful to the English and American student—clearly written, not too exhaustive, and well and systematically arranged. Born and educated in Vienna, Professor Neu-

burger had the great advantage of the care and instruction of Professor Puschmann, who did so much to promote historical studies. Having published a number of preliminary studies, he undertook to carry out Professor Puschmann's design of an encyclopedic work on the history of medicine, and in association with Professor Pagel of Berlin this was successfully accomplished (1902-1905).

In the present volume will be found the story of the growth of the profession to the Renaissance—a more or less continuous narrative may be easily and smoothly read in the large type, while in small type the student will find the authorities and special details.

Volume II., dealing with what may be termed modern medicine, is in active progress and will be issued within the next year.

WILLIAM OSLER.

Oxford.

HISTORY OF MEDICINE

PRIMITIVE MEDICINE

IN the search for the origin of any phenomenon of civilisation the investigator strives to bridge over historical time, which represents a certain height upon the ladder of evolution rather than its lowest rung, and seeks the earliest manifestations, even though these are seen but dimly and in uncertain outline. In medicine this reconstruction can be attempted, if vaguely, the more easily, since apart from the remains of a prehistoric past there are to be found not a few survivals in the speech and customs of the present (medical folklore), whilst observation of the individual and his fellow-men furnishes many comparisons. A light is, moreover, cast upon these data by the medicine of those races which even now lead an existence analogous to that of primitive man (aborigines).

If those purposeful instinctive actions which serve to mitigate pain or irritation may be considered as medical in the widest sense of the term, being as they are outward manifestations of the healing power of nature, then may medicine be considered not only to extend back to the childhood of the human race, but to exist as animal medicine.

Heated animals refresh themselves in cold water, warm their stiffened limbs in the sun, and destroy irritating parasites. Cats and dogs lick their wounds ; dogs eat grass to excite vomiting. A dog with a broken bone runs on three legs, holding the broken one so that it may set without appreciable shortening ; monkeys seek to check the flow of blood by application of the paw, and are adept in the extraction of foreign bodies, such as thorns. The medicine of animals, moreover, is not confined to self-help, but extends at times to help of others, particularly when dealing with the young.

In addition to these well-known examples, credible investigators have in recent times collected a number of astonishing observations, many of which are hardly to be explained except by the supposition of a reasoning power rising far above mere instinct. Cases of mutual help are seen particularly in animals living a social life, such as bees and ants, the latter of which care for their wounded.

Greek and Roman writers have handed down a number of fables according to which we owe many therapeutic means and measures to animals. Thus it is related that the Egyptian ibis uses its beak for self-administration of enemata; the hippopotamus, having over-eaten, presses the sharp stump of a reed into a vein in order to let blood; swallows, to heal sore eyes, employ the juice of celandine; bears, to cure stomach disorders, leaves of arum; tortoises use, as antidote to snake-bite, a variety of origanum; stags cure their wounds with leaves of dictamnus, etc.

In India, where the bitter root of *ophiorrhiza mungo* is esteemed as an antidote to snake-bite, the lesser ichneumon is designated by the natives as the animal from whom its qualities were learnt.

The above primitive actions may also be considered to have formed the foundation of human medicine, and purposeful reflex and instinctive actions are daily seen performed by children and adults. Such are scratching, rubbing or pressure, limping or alteration of position from pain, moistening of wounds with saliva or sucking them, blowing, etc.

Highly differentiated methods of treatment have been evolved from some of those primitive actions. Massage, for instance, is a development of such original rubbing, stroking or kneading.

Certain simple operations of very early date show traces of a purposeful intelligence, *e.g.* drawing foreign bodies (thorns) from the skin with the fingers, laying cooling leaves upon injured places, smearing the skin with clay as a protection against cold and insects, scratching wounds (from which originated scarification).

It is interesting to note that from many medical operations sprang future popular customs. Thus, smearing the skin with earth led to painting the body, and scarification of wounds and rubbing in of earth or rust (according to whether the pain was to be lessened or increased) developed into tattooing.

In addition to assistance given to men by their fellow-men in binding their wounds, manipulative assistance in childbirth and care of the child are of remote origin. Hence woman is the first physician and has maintained her position throughout the ages.

The commencement of surgery dates from that moment when instruments of daily use, the weapons of civilisation, were used as means of healing. Such were, in earliest times, flints, thorns, splinters of wood, shells, fish-bones, pointed bones, teeth, horns, etc. With such means foreign bodies could be extracted, abscesses opened, scarification and blood-letting performed. To the instruments of daily life were added its manipulations as assistance to the art of healing; for instance, the means of mending broken weapons served as a pattern for primitive treatment of fractures.

Experience, possibly in war, that certain injuries could not only be

survived, but might even prove the means of curing ailments, may well have originated the idea of operation, and surgical dexterity grew with the improvements in manufacture of instruments in the copper and bronze ages. Certain members of a tribe distinguished themselves by their special dexterity and acquired a reputation as experienced men capable of healing; thus through their successors arose gradually the class of medical empirics.

It is a surprising fact that, as has been proved, so severe an operation as trephining the skull was attempted as far back as the early stone age—a phenomenon which can be better understood in the light of the love of operating and surgical dexterity found in many of the present-day aborigines.

Trephined skulls from the neolithic period have been found in most European countries, in Algiers, the Canaries, North America, Mexico, Peru, and the Argentine.

Well-cicatrised trephine-holes in many of these skulls prove that this severe operation had even been performed two or three times on the same individual. The bone was either chipped away piecemeal or removed by a curved saw-cut with a sharp-edged flint instrument, or possibly the skull may have been opened by rubbing down the bone with a flint. The indication for trephining—if a deduction from the conditions existing amongst present-day aborigines is permissible—may have been headaches, convulsions and mental disorders.

Traces of prehistoric surgical technique survived well into historic times in the fact that amongst many nations certain time-honoured operations were only to be performed with a stone knife, as for instance in post-mortem section by the Egyptians for purposes of embalming and in circumcision by these and by the Jews. It is also remarkable that long after iron had become the principal metal of daily use, the majority of surgical instruments were made, not of it, but of bronze, as is proved by numerous discoveries upon what was once Roman soil.

Many researches throw light upon the diseases and injuries of the osseous system of neolithic man. Thus fractures of various bones (some healed almost without deformity), injuries (from flint arrow-heads), ankylosis, inflammatory processes, caries, necrosis and rickets have been described.

The same holds good for the bronze age, in the graves of which period arrow-head injuries and arthritis deformans have been noted.

Nomads, surrounded by wild animals, exposed to all vicissitudes of weather, filthy and often lacking food, these rough hunters and fishermen were exposed, not only to injuries of all kinds, but also to insect-bites, parasites, tumours, skin diseases, catarrhs, inflammations of internal organs, fevers and poisons.

Internal complaints, often leading to great infirmity, had to be left to

nature, till gradually medicines were evolved from various food materials and poisonous plants. That chance and empiricism led to a knowledge of remedies in very early times can be confidently assumed, since the myths of all countries indicate knowledge descending from prehistoric times, and all nations, from the earliest dawn of history, as well as aborigines of the present day, have been in possession of a considerable store of remedies. The chance which originated these empirical methods and the hidden paths by which they passed from individual experience to common knowledge must remain for ever unrevealed by historical research, the more so since the mysticism of early man surrounded nature and life with a veil of magic.

It would lead us too far to discuss in this place primitive man's conception of the universe, with its gradation from fetishism and belief in portents to animism and polytheism, or to trace in detail the interesting relationship between demonism and medicine—it will suffice to indicate the principal varieties of mysticism in primeval medicine and their psychological sources.

This fact may again be emphasised, that the foundation of medical thought lay in a scanty empiricism. The relation of cause to effect was clear even to primeval man in such cases as accidental injury (bites, stabs, hacks, arrow-wounds, etc.), or pain from a penetrating foreign body or from parasites. Death, too, from severe injuries, loss of blood, or hunger, was a readily comprehensible phenomenon. The necessity for explanation, however, was not confined to cases of such obvious causation. Daily exigencies called for alleviation; with life itself in the balance, the instinct of self-preservation—if not natural curiosity—demanded imperatively an answer to the riddle.

The chain of reasoning in primeval man—the first theory in medicine—was only a short one, since the limitations of his imagination provided him with no standard of comparison outside his own individuality; primitive thought saw in every illness not readily susceptible of explanation, where the sequence of effect upon cause was not immediate—as in most illnesses—the influence of a stronger malevolent will, of a demoniac power. Thus poisoning, where there existed an apparently enormous disproportion between cause and its operation, was to him only magic.

The fundamental errors into which the medical thought of primitive man was led were, in the main, those which can be traced in various directions throughout wide epochs of medical history. They consist in the explanation of everything surpassing contemporary experience or comprehension as supernatural or transcendental, in the attribution to the unknown of a personality (ontology) superior to the mechanical laws of nature, in the subjective presumption of a relationship between ideas where no connection exists of objects in

reality. (A characteristic example of the last-named logical error is found in the following. When the Yakutes, during a small-pox epidemic, saw a camel for the first time, they took it for a malevolent deity which had brought the visitation upon them.)

The supposed origin and working of these magical influences varied according to locality and intellectual development; with the lapse of time different views were concurrent even in the same race. The fundamental ideas, however, remain universally the same and are always derived from concrete phenomena leading to erroneous deductions.

Such beliefs, intimately connected with the evidence of the senses, were, for instance, in a malevolent being, potent in magic as the author of pain, or in sickness resulting from enchantment through a blow, stab, or missile, through poison, a noxious vapour, some animal entering the body unawares (a worm), or some foreign material (stone, piece of wood, straw or bone). One can easily understand how real occurrences in medical experience and definite painful sensations gave rise to fantastic misconception. According to other representations, suffering was caused by spirits of the departed, or demoniacal animals, which even entered the bodies of the sick (possession). Allied to this is the belief in specific evil spirits for certain diseases which were regarded as their personification.

The origin of such belief may be sought in dream pictures (which primitive man took for reality) and especially in nightmares with their terrifying phantoms.

Convulsions, too, and insanity, with accompanying facial distortion and alteration of the entire individuality of the sufferer, produced this illusion of a changed being. A more abstract conception, and one betokening a higher ethical level, is that which saw in sickness a trial or punishment for evil-doing.

Although amongst contemporary aborigines there may be some who have sunk from a once higher civilisation to their present low state, they nevertheless afford us our best insight into the medical thought of primitive man.

The reliability of this source is borne out by the fundamental uniformity of the medical conceptions of different aboriginal races, and still further by numerous analogies with traces of the supernatural in the medicine of civilisation and with folk-medicine.

Supposed causes of disease, not mentioned above, are also:—the “evil eye,” the vampire, loss of the soul through magic, or of the shadow, or of portions of the body, alteration of the position of the body, sympathetic transference of disease.

It is remarkable also that, amongst many races of very low civilisation, natural causes of disease are also taken into consideration, *e.g.* unhealthy winds, ill-adapted nutriment, bodily over-exertion, “infection” (in tuberculosis of the lungs), inheritance (leprosy, epilepsy).

Besides dream manifestations, other observations in the realm of medicine have had an influence upon the conception of the world of evil spirits, *e.g.* the sight of human monstrosities.

Amongst animals, which serve as models for representations of the soul or for spirits of disease, the “worm” plays no small rôle. There is a connection between this and the fact

that maggots are found in the putrefying body and that real worms are observed to excite disease in man and beast or are found under the bark of decaying trees. A reference may here be made to the belief in "tooth-worms," as it occurs in European folk-medicine and in oriental medicine.

As primitive man thought to have established the origin of sickness on a demonistic hypothesis, his therapeutics were therefore ætiological—magic had to be met by magic.

Primitive man looked upon illness and recovery as a contest between two opponents wielding sorcery—a contest in which the weapons were derived from the armoury of the supernatural, the mystical and the magical. This is an attempt to break natural laws rather than to assist their course by knowledge; to bring influence to bear on nature through unnatural means.

It was only to individual members of the tribe that the power was vouchsafed, through secret knowledge and mystical art (particularly in the use of poison), of being in touch with the spirit world, of counteracting enchantments, fending off demons and communicating the means whereby an enraged deity might be pacified. These were the fetish workers who, when ordinary methods of cure failed, came forward as witch-doctors and by occult means were also able to influence the weather, ensure success in the chase, a favourable result in battle and to foretell the future. In times of sickness and epidemic disease their high reputation rested on their intelligence in profiting by growing experience whilst surrounding it with a nimbus of supposed anti-demoniacal power. With belief of others in them grew their belief in themselves, and their success as healers was undoubtedly due, partly to their employment of genuine remedial measures, closely beset though these were with fantastic accessories, partly through their influence on the mind, whereby spontaneous cure was evoked (suggestion).

Naturally the evidences of magical therapeutics which have descended to our time are but scanty, consisting of amulets from the early stone and the early bronze ages (the pouch of a Northern medicine-man). The former consist of pieces of bone trephined from the skull after death and carried on a string; the latter of animals' teeth, weasel-bones, cats' claws, the mandibles of squirrels, birds' windpipes, snakes' vertebrae, etc. These remains imply a spoken language, for they prove not only the antiquity of the demonistic idea, but also, through their relation to customs existing in present-day aboriginal lore, the manner in which the forms of mysticism in medicine survive the lapse of time and the different stages of religious conviction. We are justified, from the mysticism in the medical art of

the oldest civilisations and from the witchcrafts of aboriginal medicine-men of the present day, in drawing conclusions as to the magical procedure employed by the prehistoric healers. These appear to have consisted in religious observations (sacrifice, prayer, fumigation, purification, fasting, etc.), as well as in actual means of, and procedures in, magic. To the latter belong the amulet, transference of disease, spells, exorcisms, driving out of demons and symbolic ritual in varying forms, mostly combined with the administration of medicinal drinks or with rational therapeutic measures, *e.g.* massage and blood-letting, with baths and dietetic treatment. Many remedies, originally the result of instinct or experience, acquired a secondary demonistic significance, obscuring their original import. Thus stroking, kneading and pressure applied to painful parts were transformed into means of casting out devils; blowing, breathing or spitting upon the patient, painting and tattooing, etc., assumed mystic meaning as charms against the influence of spirits. Baths, cleansings, fumigations and certain dietetic measures were transformed into ritual observances. Critical investigation proves conclusively that most of the procedures of mystical healing are, fundamentally, nothing but a symbolic employment of those customs, of those means of attack and defence which, in ordinary life, serve as protection from danger, with the difference that they are here employed against an invisible enemy. Thus, for instance, sacrifice and castigation are attempts to win favour with the higher powers, spells and exorcisms are challenges or threats, whilst the manner of casting out devils by cunning lures, frightening by noise, performing dances, shaking or beating the patient, are reminiscent of combats with real enemies.

The amulet is the oldest form of prophylaxis against disease, and originated in the belief that the possession of portions of another body endowed the possessor with their functions (and so reinforced their natural healing powers). From the original devouring of organs (such as the marrow, brain, testicles, etc.) was derived the simpler custom of merely wearing on the body portions of animals, animals immune against poison (spiders), rare, polished or odoriferous objects.

Where demonism constitutes the theory and magic the practice, diagnosis and prognosis are derived only from visions and supernatural manifestations. Thus the knowledge of the course of the disease and the prediction of its issue is partly revealed by the higher powers in dreams or in a condition of ecstasy, and partly by casual omens or by consultation of oracles. Amongst varieties of the latter inspection of the intestines held a high significance and led to rudimentary anatomical knowledge.

A lifelike impression of the methods of witch-doctors is given by a description of the conditions prevailing amongst the aborigines. The greater share of the treatment of the sick lies in the hands of the medicine-men. These purposely live an eccentric life in order to surround themselves with a nimbus of supernatural power and to impress the people with fear and wonder. "They eat apart and at unusual hours; they sleep when others are awake, and pretend to wander abroad whilst all others in the encampment are asleep; they rarely hunt and fish or do any other kind of work." In many tribes they live apart and avoid certain articles of food (*e.g.* particular kinds of meat). They habitually undertake their magical cures in grotesque professional garb. The office is frequently hereditary, or fitness for it may be dependent upon certain peculiarities of birth (twin-birth) or exceptional experiences (dreams, recovery from illness). Amongst the Shamans of the native Siberian races a neurotic constitution with a liability to epileptiform attacks appears to be the necessary condition underlying this suggestive power, or at least only those psychopathic individuals can successfully devote themselves to the calling who, under the influence of tradition and of familiarity with convulsions, acquire such readiness in auto-suggestion that, by means of external stimuli (presence of believers, repetition of incantations, beating of the tambourine-like magic drum, rhythmic movements), they are able at will to throw themselves into a state of ecstasy and precipitate convulsive attacks.

In order to make magical healing power appear the outcome of higher inspiration, the novice has, under definite guidance, to undergo a solitary and hard preparation, often accompanied by castigation and secret ceremonial, until he has the "call," *i.e.* until he is in a condition recalling certain hysterical manifestations and allied to the hypnotic. Where an organisation of witch-doctors has been attained, the novice is entrusted to older members for technical instruction; where this is not the case, the candidate attaches himself to a medicine-man, from whom he receives tuition (in finding medicinal herbs, preparation of drugs, etc.) and, by helping with the magical proceedings, gradually acquires the needful dexterity (also in juggling). Amongst many tribes the adept earns approbation only after a species of medical examination.

The honorarium is at times considerable, although the calling is not free from danger and, following an unfortunate termination of the cure, it becomes essential to persuade the friends that death has been caused through a malevolent medicine-man of an unfriendly tribe. Thus, amongst the inhabitants of Haiti, the relatives, if they believed in the culpability of a physician, held him to account and punished him, sometimes with the utmost severity. Where a real priesthood with a religious cult had been evolved, as with the ancient civilised races, responsibility for the unsuccessful issue of the cure rested no longer upon the priests, but was simply regarded as the overpowering will of the angry deity, who denied healing.

The impedimenta of the medicine-man include the medicine-pouch, which contains all manner of extraordinary objects—talons of beasts of prey, tarsal bones, snail-shells, rare stones, etc., as well as the drum and the rattle used in dancing and incantation to produce a bewildering noise. The supernatural treatment is mostly ushered in with prayer and sacrifice, and consists in fumigations, exorcism and symbolic manipulations which portray the return of "stolen" parts of the body, of the soul, the capture, binding and destruction of demons. Kneading, stroking and pressure or massage are obviously derived from empirical medicine, the painful spot being sought for; the same holding true of blowing and sprinkling (with water or medicinal fluid).

On the same lines as indirect massage is the symbolic removal, by sucking or otherwise, of the disease, no doubt upon the analogy of removal of a foreign body, as the result of which such an object as a stone previously held in readiness is frequently produced by the medicine-man with all the art of the juggler.

Even though demonism prevails and untrammelled thought is conspicuous by its absence,

a comparative survey yet demonstrates that medicine with the aboriginal races is not entirely devoid of effectual remedies and therapeutic measures.

So far as remedies are concerned, these may be sufficiently indicated by the fact that our pharmacopeia owes no small share of its most valuable contents to aboriginal sources, and appearances point to the likelihood of much being derived from these sources in the future. The aborigines are familiar with numerous purgatives, stomachics, emetics, narcotics, vermifuges, aphrodisiacs, aromatics, vesicants and rubefacients.

In addition to medicinal plants, which are in many instances expressly cultivated, mineral and animal substances were employed—amongst the latter, fat, blubber, organs, blood, bile, saliva, powdered bones and teeth, urine and fæces.

Medicines are exhibited in the form of decoctions, cataplasms, poultices, embrocations, salves and plasters, rarely as powders, infusions or pills. Some races administer enemata by means of primitive appliances and are familiar with fumigations, inhalations, snuffs, nasal douching and instillations. It is an interesting fact that in many races inoculation against small-pox (amongst the Ashantis) or against snake-bite is undertaken, the contents of a pustule being rubbed into an incision in the skin. A dim foreshadowing of the isopathic principle is seen in the inunction of fat of poisonous animals, scorpion oil, etc., to combat animal poisoning.

In addition to medicinal treatment dietetic measures play a part, also massage (in varying modifications, from a light touch to punching and treading), hydrotherapeutics (cold baths, cold and warm affusions, medicated baths, hot springs and vapour baths) and drinking of waters. All these are surrounded by a mass of ritual or superstitions and suggestive customs, which are held to be of prime importance.

Cupping and blood-letting in various forms are widespread methods of treatment. Cupping is carried out partly by powerful suction with the mouth, partly by means of simple instruments (bone tubes, oxen- or buffalo-horns, the perforated points of which, after suction, are rapidly stopped with wax, rarely by regular cupping-glasses).

Scarification is performed with thorns, fish-bones, splinters of stone, mussel-shells, pieces of bone and glass or knives. Venesection is performed upon various veins with splinters of stone or knives; for this purpose a flint is frequently mounted on a wooden handle, the stone only projecting as far as it is necessary that it should penetrate into the vein; the incision is made either by puncture or by a blow with a piece of wood upon the handle of the instrument. Amongst the Papuans a little arrow, armed with a very short flint point, is shot from an ornamental bow at a short distance into the vein.

Surgical achievements are not inconsiderable; considering the paucity of anatomical knowledge, the boldness of operations undertaken is surprising. Foreign bodies are extracted and abscesses opened with thorns or other sharp-pointed objects; in the treatment of wounds suction is employed, sometimes even a species of drainage by means of sections of bamboo; suture or tight bandaging, to promote union, is not unknown amongst some tribes. Stitching of small wounds is carried out by means of thorns, which are used to transfix both edges of the incision, the ends being then wrapped round.

Amongst some Indian tribes of Brazil it is customary to allow both edges of a wound to be seized by the sharp head-nippers of certain ants, whose bodies are then rapidly cut off; one ant after another being used, the wound is closed.

In the treatment of ulcers cauterisation with hot ashes, heated blades and irons is a favourite treatment. Arrest of hæmorrhage presents great difficulties to aborigines; for the most part they do not know how to attack it. It is sometimes brought about by means of vegetable and mineral styptics, less often it is attempted by means of circular pressure (tightly bound bandages). The treatment of dislocations is based upon no rational method, but we have astonishing reports of the intelligence with which fractures are set. Not only splints (of wood, bark and bamboo) are employed, but even immobilising apparatus, made of clay.

Of operations the majority concern the sexual sphere, such as male circumcision (circular amputation of the prepuce or longitudinal incision of the same), the so-called female circumcision (amputation of a small portion of the preputium clitoridis), infibulation, castration, the Mika operation (external urethrotomy from the orifice of the glans to the scrotum, in order to limit the progeny, customary amongst Australian tribes), Cæsarean section and ovariectomy. An equally great surgical courage is demanded for trephining and scraping the hollow bones (until the marrow is exposed, for rheumatic affections), as practised by the natives of the Loyalty Islands, and extirpation of the jugular glands. Intoxication or stupefaction by narcotics and by hypnotism are the necessary preliminaries for such severe measures. The not infrequent successful outcome of such operations, done regardless of all antiseptic precautions, can only be explained by the supposition that aboriginal races have a far greater power of resistance against wound infection than highly civilised nations. Obstetrics, which lies almost exclusively in the hands of the women, shows a very variable stage of development in different races; thus, amongst the Malays, an attempt is made to rectify unfavourable positions of the fœtus in utero, whilst in Cochin-China retained placenta is treated by trampling upon the abdomen. Menstruating women live apart from other members of the family; delivery takes place in special birth-huts which, after the lying-in period, are usually burnt down.

In spite of demonism and witch-doctors, pure empiricism was never entirely extinguished, if confined to the narrow limits of a few surgical accomplishments.

Neither could mysticism extinguish the realisation on the part of primitive man that life was dependent on breathing and the warming blood—death served as a constant reminder of this fundamental truth.

The future, however, lay with the priests. Wherever a state arose or a priestly caste became organised, and wherever, under favourable conditions, a civilisation was gradually evolved, there sprang from the isolated, widely scattered germs of primitive medicine those wonderfully eclectic systems, partly theurgical, partly empirical, which are found in the history of all ancient civilisations, and which represent the starting-point of all higher medical development.

THE MEDICINE OF THE EAST

MEDICINE IN MESOPOTAMIA

(SUMERIANS, BABYLONIANS, ASSYRIANS)

MESOPOTAMIA is the nursery, if not actually the cradle, of all culture.

The science of pick and shovel and the elucidation of cuneiform inscriptions furnish us with growing insight into a civilisation of unexpected height and many-sidedness, whose memorials, even three thousand years B.C., betoken an already protracted period of development.

According to the results of recent research, the seed of civilisation was sown about 3000 or 4000 B.C. by the Sumerians. This people it was who made a previously inhospitable land habitable and fruitful by building canals; who laid the foundations of the ancient oriental cosmogony, religion and statecraft; who invented pictorial writing, of which the cuneiform was a development; who fostered the study of astronomy and natural science, the arts and crafts.

The Babylonians and Assyrians, the Semitic conquerors of Mesopotamia, borrowed from the Sumerians the elements of morals, learning and the arts. They in their turn developed these further, setting on them the impress of their own individuality and of their changing fortunes and bringing them to a high pitch of perfection, till the sceptre of power and the torch of ancient civilisation was wrested from them by the Indo-Germans.

Babylon, the splendid ornament of Chaldea, and Nineveh, the "divinely great city," represent less the commencement of intellectual development than the most historically important phase of the same. Babylon and Assyria have given a name to a civilisation which existed before their political supremacy, and which was not entirely extinguished with its fall.

Races and nationalities most widely sundered in the intellectual sense gradually became "Babylonian" under Mesopotamian influence and bearers of Babylonian culture far beyond its temporal or geographical boundaries.

The heralds of Babylonian culture, the Sumerians, were overwhelmed by the invasion from the south-west of their Semitic conquerors, but their name was perpetuated by the

title of the Babylonian Ruler-King of Sumer and Accad — and their writing, speech and culture endured for centuries after their fall.

The Sumerians possessed originally a cursive pictorial writing (like Chinese), running in vertical lines arranged from right to left, which gradually (being turned through a quarter-circle) was transformed into a cursive cuneiform writing, running from left to right, the change being chiefly conditioned by the writing materials (clay tablet and stylus). The Sumerian tongue was artificially fostered by the Babylonians and Assyrians (after it had been lost from among the living languages) as the language of culture and education—as was Latin in the Middle Ages.

The Sumerians probably sprang from Central Asia; according to an older hypothesis, they had their origin in common with the Aryans and Chinese in the valley of the Tarim River, and in the head-waters of the Oxus and Iaxartes, from whence common ideas and knowledge (particularly in astronomy) may have spread to the subsequent habitations of these races. The analogies existing between the Sumero-Babylonian and Chinese civilisations may here find an unstrained explanation applicable also to many manifestations of Indian intellectual life, which would otherwise be considered as due to Babylonian (or possibly Greek) influence.

The majority of the inscriptions and documents constituting the source of our information have been found in the ruined cities of Assyria and are in the Assyrian language; the Assyrian hegemony (c. 900 B.C. to the fall of Nineveh in 606 B.C.) undoubtedly corresponds with the zenith of Semitic power, but the whole era of civilisation is rightly named “Babylonian,” since the Babylonians were its real founders and were at all times mostly responsible for the advance of science and art, trade and industry, whilst the technically and scientifically more backward Assyrians found their chief activity in military and administrative organisation, in the pomp and circumstance of court life.

That the Chaldeans pursued the study of astronomy and mathematics, and more particularly that of astrology, with distinction was known through incomplete traditions from classic antiquity, but it has remained for modern investigation and excavations clearly to set forth the wide range, the depth and world-embracing significance of Mesopotamian culture. Long before the time when Greece first appeared on the horizon of history, the Babylonians were able with marvellous exactitude to undertake astronomical observations and calculations; the style of writing, the pictorial representations, the military tactics and the jurisprudence of many nations were directly or indirectly influenced by Mesopotamia. The system of weights and measures shows to-day traces of the inventive genius of the ancient inhabitants of the land of the Euphrates and Tigris, and our whole system of estimation of time, our division of the circle, are amongst the many things which prove that Babylon has never ceased to exercise its influence upon the domain of intellect, and to stimulate the traffic of the world.

The astronomical data in cuneiform not only arouse the wonder of modern astronomers, but are also of practical utility. The Babylonians had two well-developed systems of astronomical measurement, two great systems for calculation of lunar phenomena and several systems for observation of the planets.

They were familiar with the precession of the equinoxes; gave the dates of the constellations in the divisions of the ecliptic; noted the heliacal rise and set of the planets and

their opposition with the sun; calculated from the autumnal equinox the period of the commencement of the astronomical seasons, the velocity of the moon, the law governing the velocity of the sun, the duration of the year, the mean synodic month; observed meteors, falling stars, the weather, etc. Naturally mathematics were in a corresponding state of advancement: two systems of notation were in use, the decimal and the sexagesimal. Of Babylonian origin were, amongst other things, the clepsydra, the division of the circle, measurement of time according to the sexagesimal system (360 degrees, a double set of hours, 60 mins. 60 secs.), the system of weights and measures common to many races, most of the names of the Zodiacal circle, the 12 months, the 7 days of the week, the relationship in value of gold and silver. The Babylonians advanced the technique of sieges and means of communication—introducing the horse—carried on trade far and wide, possessed an excellent legal system and accomplished much in the arts (weaving in colours, carpet-making, pottery and glass-blowing) and as lapidaries.

In sculpture their realistic representation of animals occupied a prominent place; their architecture reached a high level of excellence; of music it may be noted that the eleven-stringed lyre is represented on a Babylonian sculpture of the earliest date. Babylonian cultural influences made themselves felt particularly in the domains of mathematics, astronomy, and meteorology and in the art of writing, but also in the arts and mythology. These influences extended directly to the nations of Western Asia, to Egypt and probably also to India. It must be conceded, however, that the adoption of Babylonian culture in no way prejudiced independent activity, and that the pupils not infrequently surpassed the teachers.

The highest achievement of Babylonian civilisation, the sublimest, the esoteric fruit of the intellect of a learned and select priesthood, consists in a scheme of the universe, rounded and complete, the result of the labours of many generations, from which all details of political, social and scientific life were deduced, with a semblance of mathematical proof.

The axiom, in which the whole system rooted, consisted in the view that all things represent the emanation of divine power, that all events are divinely preordained and are accomplished in accordance with the immutable law of a pre-established harmony.

Divine will, divine activity are omnipresent; the same forces and laws govern things great and things small; all series of manifold phenomena correspond to one another like reflections in a mirror. The most important manifestation, however, is in the course of the celestial bodies, apparently erratic, really guided by strictest law. The firmament, therefore, is the great book in which is written the law of the whole universe: everything on earth has its counterpart in the heavens. Astronomy, the science of sciences, affords the clearest insight into the laws and the inter-relationships of earthly events and astrology, its practical application to life, gives the clue to comprehension of the present and prediction of the entire future.

Astrology, which probably originated in Babylonia, arose from individual facts, perfectly correct in themselves, but which, through uncritical application of the principle of *post hoc ergo propter hoc*, were made the foundation for grotesque generalisations. A succession of

periodically recurring cosmic and telluric processes was observed, which processes, from their invariable coincidence, were rightly brought into relationship (*e.g.* position of the sun, climate, seasons, vegetation). Thus, for instance, as a relationship was established between the altitude of the sun and the ascension of the stars on one hand and the seasons and distribution of warmth on the other, or the existence of a causal connection realised between the phases of the moon and meteorological processes and the state of the tides, so premature generalisation led to an extended belief in the inter-relationship of heavenly bodies with earthly things, of sidereal manifestations with events on earth.

At first attention was paid only to striking phenomena, affecting the nation at large, such as pestilence, war, fate of the king, etc. The accidental coincidence of events of this nature, which were carefully noted, with certain well-defined cosmic phenomena gave, in view of the bias towards such an hypothesis, a deceitful appearance of the coincidence being causal instead of merely temporal. Hence it was inferred that the recurrence of a definite celestial manifestation, such as a comet, at once justified the prophecy of the seemingly corresponding earthly event, such as plague or war. From the great and general to the small and particular was logically only a step, for to the endless and ordered power of the stars no bounds could be set.

Constant records and comparisons, together with false analogy, led in the end to the view that the dependence of man on the other worlds was not only general, but that the individual, to the smallest details, was a copy of the universe, and his bodily condition and fate were ultimately dependent on the heavenly bodies and were to be foretold from them. A whole system grew up of fantastic investigation into nature, which spread far and wide, received manifold modifications and, hallowed by antiquity, survived almost into modern times.

Viewed in the light of ancient oriental cosmogony, the scanty fragments of Babylonian-Assyrian medicine which have come down to us are more readily understood. Although, in the present state of research, only the most important principles with a few illustrative facts are at our disposal, even this insufficient material faintly illumines the origins of a system in medicine.

Babylonian-Assyrian medicine may in general be said to possess a theurgical-empirical character; at least, this is true from the time when, under the influence of an educated priesthood, theory was deduced from experience, and facts acquired empirically were systematised from the point of view of a demonistic religion coloured by astrology. As a result, the system so put together dominated thereafter all medical thought and action. There was indeed a coexistent residuum of medical methods and ideas of purely theurgical or purely empirical nature, although the latter were probably only few and far between. Life, sickness and health are supposed to be fundamentally dependent upon metaphysical forces, gods and demons to be influenced by the stars in their courses, but on the other hand they are brought into relationship with the blood and its changes—hæmatic theory—whilst breathing received only occasional consideration as a secondary function.

So far as the teaching of the Babylonians upon the functions of life and structure of the body is concerned, the scanty available material enables us to state the following:—The

live organism contains body and soul, the seat of understanding is the heart, and the central organ of the blood is the liver. The blood was looked upon as the actual vital principle; and it is noteworthy that two kinds were recognised—day-blood and night-blood, red arterial and dark venous.

The view that the body juices, particularly the blood, constitute the foundation of life is found in the myth of the creation, wherein one of the gods is decapitated and his blood mixed with earth. There is reference in the myths to "water of life," which indicates the preponderating Humoral Theory—a doctrine that found an analogy in the fact that Mesopotamia owed its fruitfulness and agricultural prosperity to the Euphrates and Tigris.

It is not to be imagined, however, that the significance of respiration escaped them, only that it did not play the part in the theories of life and disease of the Babylonians that it played in the medical lore of other nations.

Amongst the ideograms of Sumerian picture writing are to be found representations of the different parts of the body. Such representations, so far as they have as yet been deciphered on cuneiform inscriptions, indicate only the most primitive knowledge derived from domestic anatomy or sacrifices. Sacrificial inspection had great importance from the point of view of prophecy, stress being laid upon real or fancied abnormalities of the liver. As models for this liver-viewing were used representations of the liver of sheep or goats—two such terra-cotta models dating from some 3000 years B.C. have been found. The under surface is divided into quadrilateral spaces by straight lines and there are a number of holes which either pass right through the liver substance, or only appear as pits. Inscriptions, methodically arranged upon varying portions of the liver surface, contain prophecies upon the future state of the country or the fate of the king.

Disease was always considered as something foreign to the body—introduced from without and frequently thought to be personified as an evil spirit. Cure resulted from the expulsion of the evil spirit, by counter-action or expulsion of the *materies morbi* in the secretions and excretions (phlegm, bile and wind were considered the causes of colic and other abdominal affections).

The web of mysticism and of less extravagant physiologico-pathological speculation, with frequent transitions from one to the other, can be recognised in the methods of treatment, partly theurgical, partly empirical. Prayers, ritual observances, exorcisms, magical formulæ, amulets and symbolical manipulations accompany or obscure a therapeutic formulary rich in healing agents as well as in other remedial measures.

Thus many prayers or hymns contain rational methods of treatment (*e.g.* wet compresses for headache), and with the growth of mysticism such methods became converted in the course of time into superstitious incantations.

Curative agents were drawn by Babylonian medicine from all three kingdoms, but so much uncertainty surrounds the meaning of most of the names that a comprehensive list cannot be compiled. The favourite ones were herbs for internal administration, salves for external application—sesame oil constituting the chief basis for the latter. As flavouring agents were used particularly date-syrup and honey; drugs were extracted with water, milk, oil or *kwass*. Many preparations made up of a number of ingredients and which were in their turn mixed with other preparations, bore secret names; for instance, "medicine of the sun-god," "dog's tongue," "skin of the yellow snake," etc. Of external applications are

to be mentioned:—inunction, friction with oil, medicinal enemata, baths, affusion with cold water, cupping. Blood-letting was also known.

The Babylonians and Assyrians distinguished many kinds of diseases, the classification having naturally a symptomatic basis. "Head disease," eye, ear and nose affections, affections of the mouth, the lips, the tongue, disease of the breast, stomach-ache, colic and other abdominal complaints, ailments of arms, fingers and nails, diseases of the skin and venereal complaints, snake-bite, scorpion's sting, women's diseases (inflammation and tumours of the breasts), children's diseases and others are found in their writings. Mental disorders—supposed by the Babylonians to be caused through magic of demons and witches—were considered to have their seat in the heart. Epidemic disease finds frequent mention, but the means of definite identification are lacking.

The connection between the medicine of the Babylonians and the ancient oriental conception of the universe is less easily proved in detail than is that of their offshoots in ancient times and in the Middle Ages. Still, the traces which have been so far discovered point unmistakably to a great medical system permeated with this idea.

One thing which seems more than probable is that Babylonian astrology did not stop at prediction of plagues or casting of horoscopes, but gradually developed into the art of prognosis in disease.

In the pursuit of the doctrine of inter-relationship of the human body with the universe, the micro- with the macrocosm, it is probable that individual anatomical regions were placed under the dominion of the signs of the Zodiac. The great influence of the constellations and of the calendar upon therapeutics can be seen in particular prescriptions relating to the seasons for the employment of medicaments. (Rational considerations, such as those of season and climate, often underlay these.)

The belief in the influence of numbers, and particularly in the malignity of the number 7, absolutely forbade that the physician should touch the patient on the 7th, 14th, 19th, 21st, or 28th day of the month (*i.e.* upon any day the number of which is divisible by 7 or upon the 49th day from the commencement of the previous month). The composition of prescriptions also betrayed their predilection for juggling with figures. This is seen in the enumeration of the drugs (the number is frequently given at the end, wherein 7 or its powers are constantly in evidence)—the composition of stock remedies from a definite number of ingredients.

The influence of astrological fatalism upon Babylonian medicine is nowhere more clearly seen than in the prognosis which constituted the summit of their medical knowledge.

Traces of the prophet's mantle still clung to the physician and nothing could have shown more clearly than Babylonian medicine where the origin of prognosis is to be looked for, what were the intellectual methods employed in its early development and how the transition from supernatural to medical thought was effected. It must be premised that astrology constituted only part of the general belief in omens. According to this belief, in addition to celestial phenomena, all events of note, encounters, etc., assume the rôle of portents, affording an insight into future fate. The priesthood of Babylon had by means of enormously comprehensive records and by elaborate systematisation of the same, created a whole literature, so that omen writings constituted an integral portion of the library of Assurbanipal.

Particular attention was paid to the appearances and movements of various animals (such as the sudden appearance of an animal in a house, from a gate, meetings with dogs or calves, the manner of lowing of oxen, the flight of birds), to the occurrence of abortion in animals and human beings, and to dreams. From all these events conclusions were drawn as to the future—as is done in superstitious circles at the present day.

Medicine also served as the handmaid of priestly prophecy—its observations being utilised in predictions (deformities, congenital anomalies).

The interest of the priesthood in omens gave in turn an impulse to the collection of series of observations upon disease, and thus was developed the "clinical history," at first only for the purpose of prophecy, later in order to predict the fate of the patient and the outcome of the complaint. In this sense, the observations made upon the patient acquired the value of omens (*e.g.* the expression of the face, the state of the hair, the behaviour of the blood drawn in blood-letting, the urine, etc.); each individual symptom, since the link between the cause and the pathological process was not known, remained a token (of recovery or death), an indication of prognosis, not of diagnosis. Hence the empirical facts of clinical observation stand on the same level as dreams and astrological speculation. The next step by which medical knowledge advanced consisted in the elimination of supernatural elements in the premises upon which prognosis was founded. In other words, inferences are drawn from those phenomena alone which experience shows to stand in relation to the disease. This step could never have been taken in the ancient East, but only in a land where, and at a time when, the divorce between the physician and the priest had become an accomplished fact—in free Greece at an epoch of which Hippocrates is the embodiment.

In the cuneiform inscriptions prophecies are found based upon inspection of the various parts of the patient's body, which prophecies, systematically arranged, deal with speech, facial expression, the constellations, right and left eye, the tongue, the right ear, neck, the outstretched right hand, the breast, the foot.

That the Babylonians practised inspection of urine and blood appears probable from certain traditions in late Greek literature which erroneously ascribed these methods to Persian medicine. In face of the religious principles of the Persians, which forbade contact with unclean objects, foremost amongst which were bodily excreta, the derivation of these customs from Persian medicine is extremely improbable.

Oneiroscopy was zealously practised ; it is probable, too, that temple-sleep was a custom in Mesopotamia (*i.e.* purposely spending one or more nights in a sanctuary in order to receive a dream-revelation from a god concerning the cure of disease or other matter). Thus the god "Serapis," as Alexander the Great lay dying in Babylon, is said to have been supplicated by the Macedonian nobles, through temple-sleep, for a possible cure.

The Mesopotamian physicians were a part of the priesthood, their reputation rising and falling with the latter. Probably there were also independent exorcisers, cuppers and layers-on of plasters, who were subordinate to the priestly and scientifically educated physician, in whose service they may well have been (as slaves). Medical remuneration and the legal regulation of medicine were accurately defined as early as the reign of Hammurabi (c. 2200 B.C.).

The laws of Hammurabi upon this subject lay down that :—

"If a physician cause a severe operation wound with a bronze operating knife and cure the patient, or if he open a tumour (cavity) with a bronze operating knife and save his eye, he shall have ten shekels of silver.

"If it be a freed man, he shall have five shekels.

"If it be any one's slave, his owner shall give the physician two shekels of silver.

"If the physician make a severe wound with the bronze operating knife and the patient die, or if he open a growth with a bronze operating knife and the patient lose his eye, he shall have his hands cut off.

"If a physician make a severe wound on the person of a slave belonging to a freed man with the bronze operating knife and kill him, he shall replace the slave by another slave.

"If a physician heal a broken bone or cure diseased bowels, the patient shall pay the physician five shekels of silver."

THE MEDICINE OF THE ANCIENT EGYPTIANS

THE kingdom of the Pharaohs has left deeper traces upon the memory of mankind than that of Babylon. Throughout all time remembrance of the culture of the land of the Nile remains vivid on account of its intimate and constant association with the civilisation of the Mediterranean nations.

For thousands of years the majestic Pyramids have kept fresh in the minds of countless races the golden age of the land of their birth; the Bible and Homer, Hellenic philosophers and historians spread afar the renown of Egyptian science and art long after the hieroglyphics had become an insoluble riddle. In the dark ages and in lands where the twilight of superstitious belief glimmered faintly, the Egyptian priesthood was celebrated as the source of profoundest mysticism and of the most occult arts. The wisdom of the ancients, like a veiled image, more wondered at than understood, wrought with its magical influence upon mind and imagination, since no one could loosen the tongue of the silent Sphinx. A corner of the veil hiding Egyptian civilisation from intrusive curiosity was first raised when the trilingual inscription, the Rosetta Stone, provided the key to the forgotten writing and speech of the Pharaohs. The sagacity of savants was then able to bring to light the intellectual treasures of the vanished centuries from temples and tombs, from inscriptions and papyrus manuscripts.

Thanks to the labours of the past century, thanks to the desert sand and the almost rainless climate of Egypt, which greatly assist to preserve the hoary remains of a past civilisation, we are far better able to review its development than in the case of less remote Greece and Rome, at least in its more salient characteristics, and we obtain an insight into the political history and statesmanship of the Egyptians, their mode of life, religious views, their artistic, industrial and technical achievements and the content of their science.

Many new perspectives opened up after the excavations of mounds and ruined cities, but not a few over-valued opinions melted in the purifying furnace of critical investigation.

The imposing architecture, the decorative ingenuity and the fidelity

to nature in artistic representation, the astoundingly advanced chemical technology, the early developed mathematical and geometrical sense evidenced in structures of every kind, the copious literature with ramifications into the philosophy of religion, pure science and poetry—all these exceed the utmost expectation, the more so when their origin in the mists of antiquity is taken into consideration.

On the other hand, the fact must be borne in mind that the records so far brought to light hardly substantiate the world-wide fame of Egyptian mathematics and astronomy when we compare these with the achievements of the Babylonians in the same subjects, and no less surprising is it that nowhere, either in religion or in the explanation of natural phenomena, do we find a scheme of spiritual life which, suppressing every individual emotion, attains to the height of a coherent conception, a pure abstraction. Even in the sublimest questions there is noticeable an inadequate definition of ideas, an excessive adherence to the sensuous and to the material which is peculiar to the psychology of the African races (fetishism, gods with animals' heads, prevalence of local gods against cosmic forces). It may be that future discoveries will modify this impression, but it is now becoming more and more obvious that the supposed exclusiveness of Egyptian culture cannot be upheld for the whole range of its development (this is proved by the language, religion and art, with their frequent loans from other countries). There was undoubtedly a spasmodic fecundation from Asia, making itself repeatedly felt (under Hyksos and Armana), overcoming the autochthonous inclination towards torpidity and the predisposition to premature generalisation from experience, whilst imparting a new impulse towards progress. Active realism allied to a mysticism with strong leanings towards the material is the characteristic feature of ancient Egypt.

Egyptian medicine leaves the same impression, so far as the sources of information hitherto tapped justify a definite opinion. There is this difference, however, that healthy realism, in the shape of an abundant empiricism, shines even through the mystical veil and adds colour to the picture, whilst the lack of higher abstractions weighs little in the balance in view of the rudimentary condition of scientific development.

The Egyptian physicians and the sanitary conditions prevailing in the land of the Pharaohs acquired a great reputation; the highest recognition that classic antiquity had to give lay in the fact that many of the Greek thinkers in the presence of the Pyramids recognised in the land of the Nile the foundations upon which was built the edifice of their own

achievements. Homer indicates these primeval influences and praises the high position of medicine in Egypt, saying of that country—

“ . . . where prolific Nile
With various simples clothes the fatten'd soil.

From Pæon sprung, their patron-god imparts
To all the Pharian race his healing arts.”

Odyssey, bk. iv. l. 320-25 (POPE).

Herodotus declares Egypt to be the healthiest of countries, but filled with physicians of whom “one treats only the diseases of the eye, another those of the head, the teeth, the abdomen or the internal organs.” Diodorus says that Egyptian physicians looked upon excessive consumption of food as the main cause of disease, cured chiefly through fasting, emetics and purgatives and were under obligation to treat soldiers and travellers without fee. The same author remarks that the unsuccessful issue of a course of treatment, conducted upon recognised and prescribed lines, was not to be laid to the blame of the physicians, whereas independent procedure, going outside the bounds of tradition, carried the death penalty with it, in case of a fatal result. According to Clement of Alexandria, the medical science of the Egyptians was contained in the forty-two Hermetic books whose authorship is ascribed to the god Thot (Hermes of the Greeks).

Homer's tribute and the references of the Greek historians suggest a great age for Egyptian medicine, and the estimates were not far removed from the truth.

We know now that the Greeks, when the land of the Nile was opened to them in the seventh century B.C., encountered the decline, not the zenith, of Egyptian medicine. If the originality of the literary output be accepted as a criterion, the era of its highest development is to be referred to a period about 2000 years B.C. It has been definitely proved that the two papyrus rolls which come chiefly into consideration as bearing upon Egyptian medical knowledge—the Ebers and Brugsch papyri—were written about the middle of the sixteenth and fourteenth centuries B.C. respectively. Both these works, however, are only compilations of older writings that in part date back to the times of the Pyramids—about 3000 B.C.

The Egyptians, in common with most of the ancient civilised races, endowed the art of healing with a supernatural origin and brought a number of deities into close relationship with medicine. Those most frequently mentioned in this respect were:—the sun-god Ra; the discoverer of many medicines, the wonder-working Isis (earth), with her son Horus; Neit, worshipped at Sais; the moon-god Thoth (Duhit or Hermes, discoverer of the arts of reckoning and measurement, founder of religious and scientific writings, hence of medical literature); and the son of Ptah Imhotep (Aesclepios, possibly a deified priestly physician), whose principal sanctuary was in Memphis. Thoth was symbolised by dog-apes and dog-headed men and the ibis and was the particular god of medicine. To him

was ascribed the discovery of the enema (founded upon the supposed observation that the ibis injects sea-water into the rectum with its long beak). The importance of Imhotep ("he that comes in peace") grew with the rise of Memphis and its school of priests. The god Chnum with rams' horns, and the goddesses Sekhmet, Pacht and Bastet, with cats' or lions' heads, were worshipped as the tutelary deities of procreation and childbirth. The god Set (or Typhon) represented evil, and was the bringer of pestilences. He was depicted with an ass's head.

The physician belonged to the priesthood, to that caste, viz., to which, in addition to religious worship, the care of all learning was entrusted. Medicine, together with the other branches of knowledge, was taught in the schools existing in connection with the temples—the most celebrated being in On, Sais, Memphis and Thebes. The medical adepts undoubtedly received practical as well as theoretical teaching (a fact inferred from the holy books and their commentaries, inspired by the god Thoth); opportunity for this was afforded by the number of patients who sought care in the temples, whilst the physician-priests also visited the sick in their own houses. The identification of the physician with the priest brought advantages and disadvantages: on one side regular education was ensured, against which the unskilful could not prevail and the physicians, as members of the priestly college, were in receipt of salaries from the temple funds. On the other side science was blended with theurgy and lay under the ban of a divinely inspired, unprogressive tradition, which set the narrowest limits to individual enterprise. Thus, whilst we hear much of celebrated schools of medicine, we hear but little of any outstanding individualities and though the schools may have diverged from one another in particular views, medical sectarianism was not possible.

The differentiation of the priest-physicians into physicians in the strict sense of the term, surgeons and exorcisers, is proved to have been of early origin (the exorciser had the highest position); the introduction of specialism, however (as reported by Herodotus), was probably peculiar to the period of decline of Egyptian medicine. The individual priestly schools appear, according to the Ebers papyrus, to have cultivated certain special branches. The priestly colleges, as corporations, came to assume the position of authority in medical matters and supervised medical activity (the head priest of Sais bore the title "First of the Physicians"). Obstetrics (and cosmetics) were in the hands of expert women, foremost among whom were the midwives.

Priestly science brought to bear upon methods of healing and drugs no mean knowledge of natural phenomena (zoology, botany, chemistry):

botanical gardens were in existence ; chemistry, the name of which science is to be traced back to *χημ*, the indigenous name of Egypt, had attained a considerable degree of development,—knowledge of the structure and functions of the human body remained nevertheless at a very low level. The available sources of information, consisting, as they do, only of practical medical works and books of prescriptions, furnish no grounds for conclusive judgment. They prove distinctly, however, that to attribute to the Egyptians, on the ground of their methods of embalming, any considerable knowledge of anatomy, as has been previously done, was quite unjustifiable. What they did know was vastly less than they might have learned from such procedures. In this connection it must not be forgotten that the evisceration preliminary to embalming was undertaken, not by physicians but by workmen, and that the ritual observances surrounding the custom made the satisfaction of scientific curiosity almost impossible. The primitive conceptions of anatomy possessed by the Egyptian priest were derived from accidental experience and observations during slaughter of animals—observations which, as with other peoples, were woven into a network of preconceived speculations upon natural philosophy.

In the most remote age (Negada period) excavations prove that there were two forms of burial. In one the body occupied a squatting position and was enveloped in a covering of skins ; in the other the separated portions of the disarticulated skeleton were entombed after removal of all the soft parts, as is done by certain African races of the present day.

Embalming was only a gradual development : at the time of the second dynasty it was not a universal usage ; up till the time of the fifth dynasty disarticulation of the skeleton was practised as well. Springing from the belief in resurrection in earthly shape and in the dependence of the welfare of the soul upon conservation of the body, grew the desire to counteract the rapid putrefaction taking place in a warm climate. The incidental hygienic advantages were doubtless only a secondary consideration. Natural mummification, occurring in bodies sepulchred in caves or buried in the desert sand, set the example ; artificial dessication was promoted in the first place by saltpetre, which withdrew water from the tissues and destroyed the fatty parts. Following this were used antiseptic materials such as myrrh, incense, cassia, etc., and the process received indispensable addition by evisceration, to which was added irrigation of the cavity with palm-wine and packing with balsam, cedar, pitch, asphalt, shavings, wrappings, etc. Later the corpse was swathed, each member separately ; the completed mummy was then laid in a wooden coffin which, in the case of the rich, was enclosed in a stone sarcophagus. Embalming was carried on in the “ cities of the dead ” (where those whose business it was to tend the dead lived together) ; burial occurred in the earliest ages in subterranean chambers, later in places set apart above ground.

Pictorial representations of embalming are to be found upon many mummies, and fairly exact descriptions in Herodotus and Diodorus.

There were three methods (the bodies of the poor were simply laid in saltpetre solution) ; female bodies were given to women for embalming, and only handed over to men after four days.

The extreme antiquity of the custom is proved by certain formalities which, according to Greek reports, were carried out upon evisceration of the body. First of all, the *γραμματεὺς* showed the line of incision, whereupon the *παρασχίστης* cut open the left abdominal region with an Ethiopian flint-stone knife and ran away, whilst the spectators pelted him with stones (emblematic of stoning as a punishment for violating the body).

The brain was removed through the nose by means of a bronze hook. The viscera seem to have been variously treated: according to one account, they were taken in a vessel and thrown into the Nile, with invocation of Ra; according to another, they were replaced in the body after cleansing and embalming. Frequently, however, they were placed apart in four vessels, corresponding to the four demons of death. (The first vessel, the lid of which bore the human head of Amset, contained the stomach and large intestines; the second, dedicated to the dog-headed Hapi, contained the small intestines; the third, with the jackal-headed Duamutef, hid heart and lungs; the fourth, with the hawk head of Kebsenuf, had liver and gall-bladder.)

The chief portions of the body—though certainly without reference to minute details—played an important part in the writings, speech, and mythology of the Egyptians. Not a few hieroglyphics represent segments of the body; the language contains not only a considerable number of names of these, but uses them in illustration of abstract ideas: the entire heavens were represented anthropomorphically, with constellations as limbs. Even the division of the land was anatomical, since each of the fourteen districts corresponded to a part of the body of Osiris.

The verification of Egyptian terminations, however, presents many difficulties, amongst which must be reckoned the fact that occasionally the same word serves to describe totally different parts of the body, *e.g.* the ear and nose.

As may be seen in hieroglyphic ideograms and in pictorial representations, the discoveries made in dismemberment of animals (culinary and sacrificial) were applied by analogy to man; the lungs, for instance, being always represented as six-lobed (mammalian lung).

No special anatomical writings have come down to us, but one of the Hermetic books is said to have contained a description of the human frame, and according to native tradition the second king of the first dynasty—Athothis—is credited with the authorship of anatomical works (possibly a popular etymological confusion with the Egyptian Hermes—the god Thoth).

Judgment of the extent of Egyptian anatomical knowledge rests only on scattered statements, such as enumeration of the parts of the body (in the Book of Death, in magical incantations, etc.). More detailed is the description of the vascular system, the centre of which is the heart. In the Ebers papyrus there is in two places talk of the vessels, “*metu*,” under which description other hollow organs besides the veins are included, as well as nerves and tendons.

The physiological speculations of the Egyptians rested upon analogy from the external phenomena of nature to man, with less of observation of the stars than prevailed in Mesopotamia, since in Egypt the seasons are regulated, not so much by the heavens as by the rise and fall of the Nile. The sharp division between the land made fruitful by the overflowing water (water—earth), the influence of the sun’s warmth (fire), and of the winds (air), the periodical rise and fall of the Nile, the useful influence of the canal system bringing about proper irrigation of the land seemed to symbolise the structure and life of the organism, composed as it is of solid (bone, flesh—earth, humus) and fluid parts (water), its widely ramified

vascular system (canals) conveying the blood, and recalling, in the pulse, the rise and fall of the Nile, internal warmth (fire), and breathing (air, wind). Egyptian physiology possessed a touch of local colouring in the stress it laid upon the vital importance of respiration, in contradistinction to the hæmatic theory preferred in Mesopotamia.

The theory of the four elements, supposedly first developed in Egypt—and which many have thought to be visibly expressed in the shape of the Pyramids and obelisks—is nowhere categorically laid down. The derivation of life from breath and the fluids of the body played an important part in ritual, which prescribed the dedication to gods and to the dead of consecrated smoke and water, typifying the breath and the water of life.

The influence of locality upon the interpretations of analogous natural phenomena is strikingly shown in the fact that hypersecretion, as in the case of long-continued discharge from inflamed eyes, was described by the Egyptians as “rising of water to the eyes” (from the heart), in contrast to the Greek view, which interpreted the same phenomenon as a flow from the head. In Egypt irrigation is not, as with us, due to falling rain, but to a rising of the Nile.

The respiratory movements placed the entrance to and exit of air from the body beyond doubt, and the paths by which the pneumatic circulation was supposed to take place seem to have been fixed with a deceptive exactness in very remote times through observations upon animal and human bodies. A part of the vascular system was seen always to contain blood, whilst another—the arteries—was always empty (*i.e.* held air). This was considered irrefragable proof that the latter were pneumatic canals, a false conclusion being drawn as to the condition in the living from that in the dead. The heart was recognised as the source of the blood-vessels.

The papyri of Ebers and Brugsch contain in the book “expulsion of the Uchedu,” which describes the air-vessels, the oldest source of the pneumatic theory. It is remarkable that there is here a distinction between good and bad air—air of life and air of death—which are supposed to circulate differently, hardly to be explained otherwise than by in- and expired air (this distinction corresponds to the separation of day-blood from night-blood in the hæmatic life-theory of the Babylonians). Heart and stomach (designated by the same hieroglyph, the cooking-pot) were supposed to constitute a double system in which the blood was prepared from the ingested food. The heart was supposed to get smaller with age.

In pathology, particularly that of epidemic disease, whilst the religious and superstitious element played an important part, rational observation predominated.

The Egyptians supposed illness to be due chiefly to overeating or to worms—real or suppositious.

According to the particular manuscript, magic papyrus, or formulary, either a suppositious or empirical ætiology prevailed. Mysticism placed the different parts of the body under the dominion of particular deities and supposed them subject to the baleful influence of certain evil spirits.

That the "worm" should have in time become the chief symbol of disease need cause no surprise in a land where animal parasites actually play so large a part in its causation. Generalising, the Egyptians inferred the presence of morbid "worms" where it could not be proved, and supposed them to originate from the juices of the diseased tissues.

What were described as diseases were either isolated symptoms or symptom-complexes. Recognition of the latter shows, naturally, the more highly developed diagnostic reasoning power.

In the Ebers papyrus are found therapeutic formulæ for a number of different affections; the meaning of the signs for the various diseases, however, is surrounded by many difficulties—philological and medical—which have not so far been entirely overcome. Amongst others the following are enumerated:—abdominal affections (amongst which probably dysentery), intestinal worms, proctitis, hæmorrhoids, epigastric affections, heart disease, headaches, urinary ailments, dyspepsia, swellings in the neck, angina, disease of the liver, about thirty eye diseases, affections of the nose, ears and teeth, tumours and abscesses.

In the matter of diagnosis it may be taken as proved that the Egyptian physician not only practised inspection and palpation, but examined the urine.

The most interesting point, however, is, as would appear from the Ebers papyrus, that acoustic phenomena were not neglected, for it is difficult to interpret otherwise than in the light of auscultation the sentence, "The ear hears."

The greater part of Egyptian medicine consists of therapeutics. Its hybrid form, half priestly, half empirical, brought it about that theurgical and rational measures of treatment alternately rivalled, assisted, or mutually influenced one another.

In the more recent MSS and in the lay papyri, prayers, blessings, magical formulæ, incantations, and symbolic procedures predominate; in those of older date and in the very earliest books of prescriptions pharmaceutical therapeutics prevail, although theurgical influence is not absent. Frequently it is found that prayers and invocations precede prescriptions; magic-bearing sentences accompany the preparation of drugs, or are to be spoken by the patient while taking the same, and the suggestive influence of certain mixtures is enhanced by their composition being described as of divine origin. Emetics, purgatives and enemata were employed in order to remove the "*materia peccans*" in accordance with the fundamental principles considered to govern the incidence of disease. The same end was served by blood-letting, diaphoretics, diuretics and sternutatories; the unwholesome air was got rid of by the excitation of ructus and flatus (onions, leeks, beans). The pharmacopeia—derived from the vegetable, animal and mineral kingdoms—was unusually

well stored. In particular may be mentioned the use of copper salts and oxymel of squills as emetics, of castor-oil (with beer) as a purgative, of pomegranate as a vermifuge, of opium and hemlock. The importation of foreign drugs (Arabic and Indian) was chiefly accomplished through the Phœnicians; a section of the Ebers papyrus is of Phœnician origin. An exception to this was the commercial expedition of discovery to the shores of the Red Sea undertaken by the Queen Hatshepsut (c. 1500 B.C.)—probably the oldest expedition of its kind of which record exists. The Egyptians became directly acquainted with a number of new drugs by means of successful campaigns against Asiatic nations (under Thothmes III. and Rameses II.), doubtless also with much of the medical mysticism of the Mesopotamian priesthood.

The forms in which medicine was exhibited were draughts, electuaries, masticatories and gargles, snuffs, inhalations, salves, plasters, poultices, injections, suppositories, enemata (an Egyptian discovery) and fumigations. The last—in the spirit of the pneumatic theory—were for the purpose of removing the “evil air” (or the evil odour of the same) by another stronger smell, or of replacing it by a pleasant one. Gum benzoin, styrax, etc., were used for this purpose, but the favourite remedy was a fumigatory composed of juniper, myrrh, flag, and similar substances, which was called *Kyphi*. (As late as the Ptolemaic period the recipe for the same was engraved upon the walls of the temple of Edfu.)

Medicinal therapeutics were subject to strict rules, and it is more especially in its domain that the oppressive restraint limiting individual action made itself most felt. Acute affections could never be treated for a longer period than five days, and the medication consisted in administering a drastic upon the first day (as an introductory treatment towards eventual expulsion of the poison); on the following four days other medicines were administered (as an after-cure); hence are to be found the subscriptions, “for one day” or “for four days.” The prescriptions had a similar form to those of the present day, consisting of a basis, adjuvant, vehicle and corrective; the simple formulæ of earlier times contrast with very comprehensive medicinal combinations in the later. The quantities were regulated most exactly, the same material appearing with surprising regularity in identical dosage, whilst the weights of the drugs stand in the relation of 1 : 2 : 4 : 8 : 16 : 32 (dual system of weights).

Of the surgery of the Egyptians we know little, but there is ground for the belief that in this also they achieved much. Conclusive proof is forthcoming only as to operations upon tumours (apart from circumcision and castration).

Obstetric medicine lay in the hands of the midwives. Delivery occurred on the stool of delivery, with the assistance of four midwives. The head midwife squatted in front of the parturient woman, who was in addition supported by a woman on each side and by one at her back.

Ophthalmic surgery (the Egyptian ophthalmic surgeons enjoyed a high reputation), otology and dentistry are represented in the medical texts.

No final judgment should be pronounced upon the materials which were till recently undeciphered and which contain little of surgical interest. It may be that more pertinent writings are hidden in obscurity. The veterinary papyrus of Kahun shows that even in very ancient times, in the case of animals at any rate, the Egyptians did not shrink from operations demanding a considerable technique. Excavations have proved that they possessed the capacity to make special instruments—cupping-glasses, knives, hooks, forceps, metal rods, needles, etc.—and the dexterity with which the embalmers removed the brain from the skull without facial disfigurement presupposes manual skill in other domains. The texts certainly tell us mostly of the removal of tumours; in mummies well united fractures have been found, as well as fractures showing overlapping to the extent of 4 cm.; there is no evidence to show that amputations were undertaken.

The Ebers papyrus treats of wounds (bites, burns and insect-stings), foreign bodies, gangrene, collections of pus, pustules, stinking abscesses, new growths (fatty tumours, abscess of the neck, enlarged glands, mammary growths), external affections of the trunk and limbs (pustules, bruises, blisters, indurations, etc.) and hæmorrhoids. Dressing was done partly with linen, partly with lint (made of flax, linen, or cotton); the salves and plasters consisted of oil, different varieties of fat (of the goose, ox, pig, ass, cat, hippopotamus), wax, honey, mixed with many other substances. The cavities were packed with suppositories or pads of lint, spread with similar materials. For the removal of foreign bodies (*Filaria Medinensis*) counter-irritating plasters were employed, for operations lancet and cautery.

The following examples from the Ebers papyrus are illustrative of the methods of examination and treatment:—"When thou findest a purulent swelling with the apex elevated, sharply defined and of a rounded form, then sayest thou, 'It is a purulent tumour which is growing in the flesh. . . . I must treat the disease with the knife.'

"When thou findest a growth upon the throat of a patient . . . containing matter . . . and thou findest its top raised like a wart, know that the matter moves within it.

"When thou findest a fatty growth in the neck, and findest it like an abscess of the flesh and soft to the fingers, then sayest thou, 'He has a fatty growth on his neck. I will treat the disease with the knife, paying heed to the vessels.'

"When thou findest a tumour of the flesh in a particular part of a person's body, and findest it like skin upon his flesh, it being moist, moving with the fingers except they be still, the movement being thus due to the fingers, it is a tumour of the flesh; then sayest thou, 'I shall treat the disease by trying to cure it with fire.'"

The statement on the part of the ancients that the Egyptians practised circumcision from the earliest times finds support from the discoveries in mummies and pictorial representations (a picture of the time of Rameses II. shows the operation being performed upon a boy). The priests and nobility always subjected themselves to circumcision.

Female circumcision seems to have been a widespread custom in Egypt in very early times.

As regards ophthalmic surgery, it happens that it occupies a very important section of the Ebers papyrus, but it sheds no light upon the epidemic "Egyptian" inflammation of

the eyes, which only in the Middle Ages assumed its present important position—nor upon the knowledge of cataract operation.

The only operation mentioned in the papyrus is epilation for trichiasis. Affections to be recognised are:—conjunctivitis, the principal symptoms of which—redness, swelling, and secretion—are each treated of by themselves, inflammatory corneal opacity, abscess of the cornea, epiphora, myosis, leucoma, ecchymosis of the lids, squint, milium, chemosis, ptosis, trichiasis, etc.

With regard to therapeutics, it is remarkable that local treatment occupied the first place (painting with goose feathers).

As medicaments were used sulphate of lead, antimony (as a cosmetic), verdigris and sulphate of copper. . . .

With regard to dentistry, it may be mentioned that the papyrus contains a few prescriptions, and investigation of mummies shows a certain technique in substitution and conservation.

Midwifery and gynaecology are treated of in both the most ancient Egyptian MSS, with diagnosis of pregnancy, instruction in furtherance of conception and aid to delivery, in increase of lactation, regulation of menstruation, treatment of uterine displacement, diseases of the breast, dysmenorrhœa, etc.

As an example of the method in which pregnancy or the course of delivery was foretold, the following may be quoted from the Brugsch papyrus:—"Another direction to see if a woman bears or not, a water-melon pounded is mixed with the milk of a woman who has borne a son, and is given to the patient to drink: if she vomit, she is pregnant; if she has only flatulence, she will never bear again."

The attainments of the ancient Egyptians in hygiene and prophylaxis against disease ranked higher than their therapeutics. Viewed, not only in the setting of their own times, but from the standpoint of present-day knowledge, the greater number of their hygienic measures deserve the fullest recognition—more particularly in consideration of the heat of the climate. The statement of Herodotus is well borne out that "the Egyptians are, with the Libyans, the healthiest nation."

The wonderful edifice of social hygiene existing in Egypt must undoubtedly have been built on foundations of an experience derived from the remote past, especially of all manner of epidemics. If this first and chiefly benefited the king, the priesthood and the upper castes, it was not without its influence upon the life of the people even down to the lowest strata, and the health of the people was the king's most sacred care.

The derivation of most ailments from overfeeding, and recognition of the fact that prevention of disease is easier than cure, gave rise (according to Herodotus and Diodorus) to the custom of employing for three consecutive days in each month emetics and enemata purely for prophylactic reasons.

The Egyptian ordinations, of supposedly divine origin, were evidence of a profound knowledge of popular psychology, and were in keeping with the maxim that mankind of a certain intellectual development can, by

authority, be directly persuaded to take action in their own interest, but can only secondarily be brought to reflection. These ordinations regulated public hygiene and the whole manner of life, care of the body, clothing, diet, sexual life, and, as may be seen in many temple inscriptions, promised the pious (*i.e.* the clean and temperate), instead of transcendental benefits, long life and boundless health, with a prospect of copious issue.

"The whole manner of life," says Diodorus, "was so evenly ordered that it would appear as though it had been arranged according to the rules of health by a learned physician, rather than by a lawgiver."

As public measures may be reckoned the canal system, dating from earliest times, the system of transport, fumigations (particularly at times of epidemics), and a species of meat inspection, undertaken by expert priests, before and after slaughter. This consisted in external inspection of the beasts, inspection of the viscera, and examination of the blood by smell. Just as the inspection of meat appeared a ritual observance (sacrifice, the best portions being considered to be the fore-legs and heart), but consciously or unconsciously served hygienic interests, since flesh rejected from sacrifice was certainly not eaten by man, so can most of the rules of life of the Egyptians be looked at from two points of view.

From a practical point of view the hygienic aspect was always to the fore, the religious idea being only a cloak.

In obedience to the fundamental religious and hygienic laws, the greatest stress was laid upon the cleanliness of the dwelling, the care of the body, on dress and diet. Naturally it was the priests who set the example in the strictest rules of cleanliness: they bathed twice daily and twice nightly; every third day they shaved their entire bodies—in the epochs of the new kingdom they were always bald; wore white clothing (only of linen whilst performing their temple office), and in the choice of food carefully avoided pork, beans, and onions (on account of flatulence). In later times they only drank water boiled or filtered, their favourite drink being a kind of beer—the gift of Osiris—which they brewed from barley. As may be seen in the representations of a students' carouse, and as is proved by various extracts from the texts, the Egyptians were not averse from drinking (*e.g.* the following exhortation to a student: "Thou forsakest thy books, thou givest thyself up to pleasure, goest from tavern to tavern,—the smell of beer makes man shun thee"). Excess in this direction, as well as in that of sexual indulgence, was discountenanced by priestly orders and stringent laws. Sexual perversion is proved by the obscene Turin papyrus; the myth of Horus and Set is evidence of the primeval existence of pæderastia, and two fables which have survived tell of scenes of adultery. The prevention of conception and production of abortion was severely punished; intercourse during menstruation was forbidden; in the Book of the Dead self-abuse was named as a vice. The priests were allowed but one wife. In contrast with our views, marriage between brother and sister was encouraged and prevailed in the royal families (down to Ptolemaic times). Into the domain of sexual hygiene comes circumcision, practised as a rite, and performed upon boys of the priestly and warrior caste between the sixth and tenth years—according to other evidence, in the fourteenth year—with a flint knife.

The Egyptians devoted great attention to the care of their children. Infants were carried about, wrapped in large soft cloths; after weaning only cow's milk was given at first, later on vegetable food and water to drink. The children lived mostly in the open air and completely naked up to five years of age (barefoot to ten), with lively games (hoops, balls and dolls have been found in graves), after which time they received instruction in reading, writing and arithmetic (three to four hours a day) in the schools.

Physical exercises—in the case of the well-to-do also swimming—completed the excellent but severe education.

In the working classes the heavy work of life began early: as an Egyptian text puts it, "The child is procreated only to be torn from its mother's arms—if he arrives at manhood, his bones are broken as those of an ass."

The care of the body—possibly also prophylaxis—is closely interwoven with the use of cosmetics—extraordinarily developed in Egypt: of these we get a lifelike representation from the results of excavation. (In the Berlin Museum is the toilet-box of the queen Mentuhotep, c. 3000 B.C.) Recipes, too, have been found for painting the eyes (original use as a prevention of conjunctivitis); for restoring the hair (the oldest is found in the Ebers papyrus, and was for the queen Shesh in the third dynasty); for perfumes (amongst other things for the perfuming of the female genitalia); for keeping the skin smooth and improving the complexion, etc. Here may be mentioned devices for preserving the teeth—substitution by crowning and gold-stopping.

The highly developed hygiene of the Egyptians, as we know it, altogether overshadows their medical knowledge, so far as it is represented in the manuscripts at present available.

The disproportion is so great that it almost suggests the possibility of there being literary monuments, hidden or undeciphered, which may serve to bridge the gulf.

It may be that this disproportion tends to prove that a well-developed hygiene may arise upon the foundation of an empiricism, owing much to accurate observation, and losing little from erroneous theories.

One thing, however, stands clear to-day; at the least Egypt can be said to have exercised a powerful influence as a pioneer upon the social hygiene of Judah, upon the beginnings of medicine in Greece, and through these upon the development of mankind.

Medicine in the cuneiform and hieroglyphic writings exercised its influence far beyond the boundaries of the land which produced them, and many traces justify the supposition that, at the foci of intercourse, many new if minor nurseries of oriental medical culture were founded. Such a centre, for instance, must have been Sardis, the capital of Lydia, to the importance of which, in this respect, many Greek documents point.

Syria and Palestine, where the political and cultural influences of Egypt and Mesopotamia met in keenest rivalry, might be expected to have been the homes of a medical science resulting from the crossing of the two. The hitherto discovered material does not suffice to prove the truth of this conjecture, the less so that we are not furnished with any comprehensive view of the medical acquirements of the sometime inhabitants of these lands.

Of the Phoenicians it is known that they not only brought drugs into the international market and were the retailers of medical discoveries

and inventions, but possessed a system of pharmaceutical therapeutics, different in part from that of the Egyptians.

Phœnician formulæ are found in the Ebers papyrus. Recently the temple of the Phœnician god of medicine has been excavated, and dedicatory offerings have been found.

Of the Aramaic nation it may be remarked that numerous plant-names in their speech point to possible knowledge of the use of the same. The chief information upon the medical attainments of the ancient Israelites is derived from the Bible, where the " Elohists " and the " Jahvist " reflect the contest between the hæmatic (Mesopotamian) and pneumatic (Egyptian) theories and their practical consequences.

THE MEDICINE OF THE ANCIENT PERSIANS

THE victory of the great Cyrus erased the name of Babylon from the history of the nations and summoned the young and vigorous race of Persians to dominion over the whole of the Near East, a dominion which exceeded in grandeur the previous Semitic one, the kingdom of the Achimenes extending from the Indus to the Mediterranean—eventually even including the land of the Pharaohs.

The ancient civilisation of Babylon nevertheless persisted in its essence under the altered political conditions. The work that the Sumerians and Semites had accomplished in the course of centuries upon Babylonian soil remained untouched even after the sceptre had passed into the hands of the Iranians and Indo-Germans. In the wide heterogeneous domain of the Persians each of the many races was allowed its own religion, customs and speech—the text of the trilingual inscriptions bears witness to this. With a magnanimous policy, the conquerors even strove to fuse the national characteristics of the Zend race with those of the foreign element into an harmonious whole—an intention which can be traced in contemporary architecture and sculpture, which bore a strong resemblance to their Assyrian, Egyptian, and Ionic models, despite a superficial appearance of originality.

No great success was the result of this eclectic tendency: the collection of nations amalgamated into no coherent whole; for the Zend race, leaping at a bound from petty patriarchal conditions to a world-dominion, lacked the energy to substitute fresh equivalents for the exhausted forms of ancient civilisations. Apart from great religious ideas, the Iranians have left but little impress of their own individuality. This holds true in particular of medicine, if, as is only reasonable, a distinction be made between medicine in the kingdom of Persia and the national medicine of the Persians, while excluding the learning borrowed from Babylon which, masquerading under the flag of the Zend nation, was later passed on to the West.

Owing to the almost complete failure of the usual sources of information, we are only enabled to arrive at a very general conception of the

medicine of the ancient Persians through the religious writings carefully preserved by the Parsees of the present day, the Zend-Avesta and its literary precursors. Of this it has to be explained that many of its pronouncements were binding only on the strict followers of Zoroaster (Zarathustra).

The medicine of ancient Persia, like that of India, owes its origin to primitive Aryan medicine, and its individuality to the influence of the national system of religion.

The importance of the rôle played by medicine in the life and thoughts of the worshippers of Ahura-Mazda comes noticeably to light in the Avesta. The Book of the Law, the Vendidad, devotes to it almost the whole of the last three chapters, and therein describes its origin. "Thrita," so it runs, "was the first man of the race of Paradhata, helpful, discerning, powerful, rich, intellectual," to combat sickness and death. Thanks to heavenly grace, he was enabled to practise both medical and surgical art: Ahura-Mazda, in answer to his prayer, caused the countless healing herbs to grow and gave him a metal operating knife.

Corresponding to the strictly dualistic conception of the universe, disease in its countless manifestations was regarded as the work of an evil principle, of the devil, of Angra Manju (Ahriman), who sought in every way to harm the believer in God. Sickness, therefore, was always demoniac; the patient, one possessed.

Amongst the heaviest national scourges were to be reckoned the numerous fevers (the Avesta writings contain several descriptions, some of which include pyrexia and chill) and skin diseases. Also mentioned are: headache, vertigo, sexual disorders, deformities, poisoning (by snake-bite or poisonous plants), women's diseases (puerperal fever, disorders of menstruation—menstruation lasting nine days was considered pathological).

Such things as were supposed to be connected with the spirit of evil and with demons were also considered unclean, such as disease, bodily excretions, corpses. It is worthy of note that menstruating and lying-in women belonged to the "unclean," and were on that account isolated, having to undergo definitely prescribed purifications.

According to the legend, it was Djahi—the evil spirit of unchastity—in whom menstruation first appeared, when Angra Manju kissed her on the head. The menstruating woman was held to be unclean and to exert an unwholesome influence, therefore she was isolated (on an average for four days) in a room separated from the rest of the house, and strewn with dry straw, fifteen paces distant from fire and water—the clean elements. Naturally the Avesta prohibited sexual intercourse during this period, and it was only permitted again after corresponding purifications. Lying-in women were also considered unclean, and could only associate with men after a definite interval (forty days) and purifica-

tion. Very stringent regulations prescribed the isolation of women who had had a miscarriage, since the abnormal was considered in the highest degree a manifestation of evil influence. Great stress was laid upon purification, upon cleansing of the nine portals or openings of the body—the eyes, ears and nostrils, the mouth, the genital opening and the anus. Contact with the dead body was held to be particularly a cause of uncleanness—a conception which, from the beginning, did much to hinder the progress of medicine. According to the descriptions of the Avesta, the bodies of the dead fall to the share of the evil spirits, which possess themselves of their prey in the shape of flies; uncleanness spreads from the corpse into the house in which it lies, and to all within it. The evil influence extends to all the relatives and is greater the nearer the relationship. Laying out the dead was the work of bearers, who made this their trade and were utterly despised. The relations had to withdraw for a time from all association with men.

It may here be pointed out that, according to the Zoroastrians, who laid stress upon immortality and a resurrection, death signified the division between body and soul. Persian psychology, however, recognised as the ultimate spiritual power the vital force which guides the bodily functions, comes into being with the body and perishes with it. Associated with the vital force and united to the body, though not perishing with it, are consciousness, spirit, soul in the restricted sense of the word (will-power).

The treatment of the sick consisted, from the Zoroastrian standpoint, in the casting out of the demons of disease, in purification (taken in the religious as well as in the hygienic sense), and lay in the hands of the priests. As means were employed above all prayer and spells (holy words): “Many cures are effected through herbs and trees, and others through water, and others again through words; through the divine word are the sick most certainly healed.” As is to be gathered from these sentences, next to theurgy itself stood the “cure by herbs”; Ahura-Mazda, to limit the influence of the demons, having endowed the herbs with healing power, particularly those which are poisonous (leek, aloes, cannabis).

The Persians, like the Indians, esteemed water highly as a therapeutic measure—it served also for purification and expiation (the genii of long and healthy life ruled over water and plants). Certain ailments claimed treatment with the knife, though the ancient Persians seem not to have carried surgical interference far—otherwise King Darius I. would not have found it necessary to summon a Greek physician for the treatment of a dislocated astragalus. In the regulations concerning permission for the practice of medicine great stress was certainly laid upon operative capacity, since only he who had successfully performed three operations (upon unbelievers!) was allowed to exercise his craft upon worshippers of Ahura-Mazda. The reward of the physician’s endeavour was scheduled in a definite scale according to the patient’s means and was frequently paid in kind.

Of the theurgical methods of treatment it is to be noticed that the Avesta forbade “witchcraft,” as, for instance, it was practised by the Babylonians, Turanians, and Medes; it was the unbelievers who were supposed to possess that power (with the help of Ahriman). Prayer constituted the chief protection against the malevolence of demons. It is certain,

however, that with the Zend nation certain occasions, particularly in illness, called for the use, not of the holy writings in general, but of certain prescribed sentences much esteemed as counter-magic. Amulets were also in use (feathers and bones of the bird Varadshan, ? raven). It would appear as though a distinction were drawn between the forms of magic according as to whether a good or a bad demon were invoked, as in the Middle Ages "white magic" was distinguished from the forbidden "black magic."

Of the practice of medicine and of the honorarium the Book of the Laws says: "Inquirer! if the Mazdajsnas (believers) wish to become physicians, on whom must they first practise—on Mazdajsnas or Daivajsnas (heretics)? When such an one first operates upon a Daivajсна and he dies, when he for the second time operates upon one and he dies, when he for the third time operates upon one and he dies, then is he unfit for practice for ever."

If any one, in spite of his failure to prove his capacity, dared to practise, and he lost a patient as a result of unskilful treatment, it was looked upon as a premeditated murder.

"Whoever for the first time operates upon a Daivajсна and he recovers, for the second time operates upon a Daivajсна and he recovers, if for the third time he operates upon a Daivajсна and he recovers, then is he for ever qualified, he may at will try medical treatment upon a Mazdajсна, at will operate, at will cure by operating.

"A priest he shall cure for a pious prayer, the head of a household for the price of a small draught animal, the head of a family for the price of a moderate-sized draught animal, the head of a race for the price of a most excellent draught animal, the lord of a province he shall cure for the price of a four-span waggon."

The Vendidad laid down prompt assistance as the duty of the physician, but warned him against undue haste in treatment, which should be undertaken only after careful observation of the symptoms. A definite scheme is implied in the direction: "If an illness commence in the morning, proceed to a cure with the day; if during the day, it should be undertaken at night; if in the night, then must the physician's treatment follow with the day-break."

The ingrained religious influence hindered medicine from changing the theurgical-empirical phase of development for a higher one. But the shell of priestly symbolism hid, intentionally or without its creator's knowledge, a hygienic kernel, that certainly acted beneficially upon the health of the people.

The religious ceremonies associated with purification, the precepts of priestly origin, and therefore with a strong suggestive influence, upon personal cleanliness, diet, regulation of sexual life, strict interdiction of sexual excess and perversities, and upon many other subjects, were bound to produce upon outsiders an impression which was voiced by Pliny in the statement that the Zoroastrian teachings were derived from medicine.

The doctrine of Zoroaster was a cult of spiritual and bodily cleanliness (symbolised in the worship of purifying fire—the reflection of Ahura-Mazda) and combated all that is unclean in thoughts, words, or actions, be it in the physical life of man or in nature (represented by the evil spirit Angra Manju, symbolised by the worm and the snake). As a practical result physical cleansing, symbolising spiritual purification, was held in the greatest

esteem, in contrast with the habits of the unbelievers, particularly the unclean horsemen of the Steppes (Scythians and Turanians).

The killing of certain harmful and unclean animals and their delivery to the priests was considered a serviceable act. It was strictly forbidden to spit or to urinate into a river, or even to wash in it. Cleansings and washings as well as prayers and religious ceremonies, accompanied the most widely differing acts.

It constituted a religious duty to avoid bodily uncleanness, soiling of clothes, vessels, and implements, the degree of impurity being most minutely laid down, and precautions being taken against its transmission and spread.

Sexual vice was threatened by the Avesta with severest punishment in this world and eternal damnation in the next; such vices including adultery, prostitution, masturbation, pæderastia, and criminal abortion. Of the pæderast it is said that before death he is a devil, and after it an unbelievable monster. Incest was prescribed—even the marriage of near relations (brother and sister). From this fact may be deduced the necessity of a certain caution in judgment upon the religious-hygienic measures of the ancient East. Much that we commend as hygienic was so but secondarily, and sprang only from religious motives. When, for instance, we find purification, washing and isolation of the sick practised, we must not omit to remember that this is rather evidence of a belief in demons than a foreshadowing of antiseptics. It would otherwise be hard to understand why the priests in their festival washings and purifications practised preliminary sprinkling with cows' urine. The cow was to the Persians, as to the Indians, a sacred animal (symbol of repose)—a conception dating from prehistoric Aryan times.

A stern consequence of the belief of "uncleanness" in disease was the isolation of the incurable.

The importance of Persia in world-medicine lies less in its national medical attainments—the native doctors were far surpassed by those of India, Egypt and Greece—than in its geographical rôle in the intercourse between East and West, with consequent exchange of ideas and traffic in drugs.

An invaluable and the most lasting service was later rendered by the Sassanian princes who, despite their ardent patriotic spirit, at a time when European culture was hastening to its downfall, gave a home to Greek medicine, as well as to classical civilisation, nurtured it, and finally passed it on to the conquering Arabs.

MEDICINE IN THE OLD TESTAMENT

THERE are no medical writings that afford any insight into the medicine of the ancient Israelites at the time of their political independence except the Bible, which only sheds light upon medical conditions so far as ritual observances and religious laws are thereby affected. Even if this material be reinforced by indications scattered throughout the historical narrative or by similes employed in religious poetry, it must not be forgotten that the information concerns medicine in the Bible rather than medicine of the Jews.

The chief glory of medicine in the Old Testament lay in its social hygiene, the realisation of which was bound to promote the welfare and preservation of the nation, no matter what the original inspirations may have been. In all probability the Mosaic dispensation, like other oriental systems of religion, culminated in the thought that, in accordance with the twofold nature of man, physical and ethical purity stand in mutual interdependence.

The commands concern prophylaxis and suppression of epidemics, suppression of venereal disease and prostitution, care of the skin, baths, food, housing and clothing, regulation of labour, sexual life, discipline of the people, etc. Many of these commands, such as Sabbath rest, circumcision, laws concerning food (interdiction of blood and pork), measures concerning menstruating and lying-in women and those suffering from gonorrhœa, isolation of lepers and hygiene of the camp, are, in view of the conditions of time and climate, surprisingly rational, and, even in the light of modern science, fulfil the prophecy, "For this is your wisdom and your understanding in the sight of the nations" (Deut. iv. 6).

There can be no doubt that the hygiene of the Pentateuch found its model in the priestly hygiene of the Egyptians, and to this were later added (in details of the purification rites) ideas probably of Babylonian and Parsee origin, with which the Jews could have become familiar during the Babylonian captivity. The salient characteristic of the Mosaic laws is, however, to be found in this, that they apply, not to a particular case, but to the whole people: "And ye shall be unto Me a kingdom of priests, and an holy nation" (Ex. xix. 6).

The Egyptian origin of the Mosaic lawgiving is indicated by the words of the New Testament, "And Moses was learned in all the wisdom of the Egyptians" (Acts vii. 22).

Philo, following the ancient Jewish tradition, says that Moses was educated in the fashion of the Egyptians and of the Chaldeans (therefore subject also to the influence of Babylonia).

Clement Alexandrinus describes Moses as having studied medicine, and even chemistry, under Egyptian physicians.

Parseeism exercised an immense influence upon the religious conceptions of the Jews (belief in Satan, angels and resurrection), and doubtless many of the Parsee ritual observances particularly in measures of purification, were adopted by them. Just as the Jews altered the polytheistic trend of the Babylonian traditions and gave them an ethical value, so they clearly outlined the idea of moral purity which with the Zoroastrians had been one with that of bodily cleanliness.

Besides the Egyptians, Babylonians and Parsees, the Sabeans exercised some influence upon the Jewish laws of purification, possessing themselves exceedingly severe laws against all kinds of uncleanness, whilst they are known to have come in contact with the Hebrews since the days of Solomon. Concerning the hygiene of sexual life, the command is worth quoting which prescribed a bath following coitus, and forbade coitus with a menstruating woman or after childbirth (for forty days).

To guard against the transmission of infectious disease, particularly Zazaath (leprosy), the law required, when diagnosis was certain, not only strict isolation and cleansing of the convalescent, but also disinfection of clothes (washing and, if necessary, burning) and of the dwelling (even pulling down the house). A means of disinfection after contact with a dead body was purification with the "ashes of a red cow." A young cow, without blemish, was burnt in a fire of cedar wood, hyssop and crimson; the ashes thus obtained were kept in a clean place and to hand when needed; some of the ashes were placed in a vessel and "living water" poured upon them, some one in good health then dipped into this a bunch of hyssop and sprinkled all who had touched the dead body.

The Old Testament actually contains no little concerning medicine in the strict sense of the word. Thus we find mention of epidemics (plague?), "leprosy," conditions of lameness and contractures, mental and sexual diseases, congenital abnormalities, diseases of the skin and deformities. The descriptions of ailments are, however, so fragmentary that certain indication as to their nature is rarely forthcoming. This holds especially true of the Biblical "leprosy," which, on investigation of all references to it, cannot with certainty be identified with leprosy as we know it. Probably the term includes a number of skin diseases, and "leprosy" is the particular disease the differential diagnosis of which called for the most detailed description on account of the necessary isolation precautions (Lev. xiii.).

In the matter of causation, epidemic diseases, affecting the whole nation, were looked upon as punishments or visitations of Jehovah, but isolated traces of a rudimentary ætiological sense may be found.

It is the natural sequence of a strict monotheism that belief in malevolent demons in the Old Testament is forbidden. This does not hold universally true of the Jewish race,

as is made clear by the New Testament and the Talmud. In addition to idolatrous practices may be discerned in the "Elohists" of the Pentateuch remains of medical folklore.

Cure of disease was hoped for through prayer and sacrifice, in addition dietetic measures and medicaments were used, but apparently only sparingly: amongst the latter were baths (in the Jordan, in healing springs, oil-baths), wine, figs (as material for poultices), oil, fish-gall (for the eyes), plasters, salves, fumigations: that the beneficial effect of music on melancholy was recognised is proved by the playing of David on the harp before King Saul.

Of surgical measures circumcision is the only one mentioned: the Old Testament does indeed speak of eunuchs (made so by cutting or crushing), but it is very doubtful whether the Jews themselves ever performed castration.

Oil, wine and balsam were used in dressing wounds: bandages were applied to broken limbs.

Lying-in women were assisted by midwives, but these confined themselves mostly to comforting words: the birth-stool seems to have been early known.

The indivisible connection existing between the sanitary code and religion brought it about that the priests, the Levites, assumed the function of health officers. Their practical capacity rested upon a certain esoteric knowledge which was most likely perpetuated by means of oral tradition, but it is nowhere proved that they practised medicine as a profession beyond their obligations as sanitary officials.

The prophets were not devoid of medical aptitude, since in all ages miracles have been most in demand; this is shown by the happy cures wrought by some of them—Elisha, Elijah, Isaiah—and by certain spoken formulæ. In the schools of the prophets medicine must needs have been part of the curriculum.

According to one representation, Ezra and Nehemiah enjoyed a high reputation for their knowledge of the virtues of certain drugs. It is interesting to note that Byzantine and Salernitan authors designate a particular formula with the name of Ezora (Ezra). The influence of Babylonian medicine made itself felt at the time of the Exile from a therapeutic point of view.

According to Jewish tradition, quite a special renown for his skill in healing was enjoyed by the wise King Solomon, in whose reign the invigorating effect of cultural interchange with neighbouring nations made itself felt on many sides. Legend even ascribes to him the publication of a work on diseases and their cure, in the preparation of which the pious King Hezekiah is said to have assisted. This was probably a herb-book with

magical formulæ ; as is well known, King Solomon long played an important part in magic.¹

It has been erroneously assumed that in Biblical times no professional physicians existed, but that the art of healing lay exclusively in the hands of the priests. This supposition lacks all confirmation. It is most striking that the Bible, in no place where there is talk of healing in the non-figurative sense, makes any mention of the priests—and the fact may be called to mind that they themselves supervised these writings. But there are positive grounds for the statement that at the time of the prophets, at any rate, there were real physicians. The expression used for a professional physician, “*rophe*,” is at this period in current usage. It is expressly stated of King Asa that he sought help, not of Jehovah, but of the physicians.

Jeremiah held it as unbelievable that there should be no physician in Gilead : Job called his friends “*physicians of no value*.”

From evidence of later date, we know that special temple physicians were appointed for the priests, who, through cold baths, thin clothes, and walking barefoot upon the cold stones, suffered frequently from abdominal diseases.

The high esteem in which the physician was held is proved by the beautiful words of Jesus, the son of Sirach (180 B.C.), *Ecclesiasticus* (R.V.), chap. xxxviii.

“ 1. Honour a physician according to thy need of him with the honours due unto him :

For verily the Lord hath created him.

2. For from the Most High cometh healing :

And from the King he shall receive a gift.

3. The skill of the physician shall lift up his head :

And in the sight of great men he shall be admired.

4. The Lord created medicines out of the earth ;

And a prudent man will have no disgust at them.

5. Was not water made sweet with wood,

That the virtue thereof might be known ?

6. And he gave men skill,

That they might be glorified in his marvellous works.”

That the physicians received payment for their labours follows from Ex. xxi. 18, 20 *et seq.*, where we read, “ And if men strive together, and one smite another with a stone,

¹ According to a legend, Noah is said to have written by Divine inspiration and teaching of angels a book in which herbal remedies against disease and the seductions of demons were prescribed. Here, as with most nations, is an allusion to the Divine origin of medicine.

or with his fist . . . if he rise again, and walk abroad upon his staff, then shall he that smote him be quit : only he shall pay for the loss of his time, and shall cause him to be thoroughly healed."

From the post-Biblical period of Jewish medicine we also have inherited no specialised literature, but some light is thrown on the subject through the Talmud, where medical matters are not infrequently mentioned. The consideration of the potent influence of Talmudic upon later Greek medicine is referred to a subsequent chapter.

THE MEDICINE OF THE INDIANS

THE medicine of the Indians, if it does not equal the best achievements of their race, at least nearly approaches them, and owing to its wealth of knowledge, depth of speculation, and systematic construction, takes an outstanding position in the history of oriental medicine.

Thanks to the inexhaustible fount of Sanskrit literature, its development can be traced, in outline at any rate, from its primeval origins in empiricism and theurgy to its height as a completed system of learning.

This development is doubly interesting. On the one hand there are shown many parallels to the medical art of the Greeks, corresponding to other great scientific attainments of the Indians (in philosophy, astronomy, mathematics, geometry, philology) and to their poetic art. . . . On the other hand is seen the determining influence which the East, with the general conditions of culture springing from its soil, exercised upon the trend of medical thought.

As with the Semites, Hamites, and Mongols, in spite of a natural endowment little inferior to that of the Greeks, the intellectual impulse was lacking in the Aryan Hindu races. Under the oppression of dogmatism, individual development too soon gave place to a condition of stagnation culminating in trivial speculation, subtle formalism and bizarre fantasy—traits also expressed in a grotesquely imaginative art often far removed from beauty and harmony.

In the history of Indian medicine, as in that of Indian civilisation in general, three epochs may be distinguished :—

1. The Vedic, extending from the first migration of the Hindus into the Punjab to about 800 B.C.
2. The Brahmanistic, marked by the dominion of the priestly caste, representing the Indian Middle Ages.
3. The Arabic, commencing about 1000 A.D.

The Vedic epoch is so called because its state of civilisation is represented by the four Vedas, the immemorial holy writings of the East (consisting chiefly of religious hymns and dogmatic scientific exegesis).

The Rig Veda (1500 B.C.) and the Atharva Veda have the greatest significance from a medical standpoint. From these literary monuments it is seen that the most ancient Indian medicine, fitting empirical knowledge into a framework of polytheism, and of a demonistic conception of nature, has its centre of gravity in theurgy. Empiricism claims for itself a few

fundamental facts concerning anatomy and diseases (including poisoning), the action of certain medicinal herbs, the use of cold water, and also presides over primitive surgical undertakings. The traces of physiological speculation, which may here and there be discerned, deal with such subjects as the process of conception, and prove that air (breath) was looked upon as the chief source of vital power.

Corresponding to the growth of religious consciousness, the theurgy in the older Vedic epoch differs from that in the later. In the Rig Veda prayer and invocation to the gods predominate (illness is the result of misdoing) ; in the Atharva Veda are chiefly found magic and spells, directed either against the demon of disease itself or against the putative instigator of the witchcraft (wicked men).

Amongst the diseases, of which not a few are mentioned, Takman (*i.e.* malignant fever) played the most important part, whilst the supernatural observances included prayer and sacrifice, the use of charms and many methods of exorcising demons (*e.g.* by incantations and loud noises). It is a noteworthy fact that attempts were made to transfer diseases through magic to men or animals (cold fever to frogs, jaundice to parrots). Medicinal herbs, the most important of which was the sacred Soma (possibly *Asclepias Syriaca*), are subject to the higher powers, and were employed, demoniacally personified, against disease. It is interesting to note that the most ancient Indian medicine (like primitive medicine in general) makes occasional use of isopathic or homeopathic principles. Thus yellow plants were used in jaundice, poisoned arrows against poison. Although medical witchcraft lay originally in the hands of the priests, the physicians appear to have constituted an independent class by later Vedic times, and to have been, to a certain extent, in opposition to the Brahmins.

The ancient Indian healer carried his remedies with him in a little box, and he undertook his cures, as has been implied, less from philanthropy than with a view to profit.

In later Vedic times there were deities with definitely medical functions, or pest-gods, but in the earlier epoch there existed no such specialisation, only universal deities, some of whom, more than others, were in relation with medicine and disease. To these belonged the Asvins, heralds of dawn (*Dioscuri*), Rudra, the father of the wind. Personified, and therefore appealed to, were—diseases (such as fever), Takman ; the healing power of water (in very early times bathing and drinking cures were known in India) ; the virtues of certain plants, particularly the plant Soma, from which an intoxicating sacred drink was made both by the Indians and Persians.

The magical formulæ of the Atharva Veda are strongly reminiscent of those of other nations, corresponding particularly closely with charms and invocations of the Germanic races. The following is an example of the manner in which it was sought by flattery to transfer disease to foreign, unfriendly, or despised nations : “ Obeisance to Takman, with the shining weapons !

O Takman, go to the Mudshavant or farther. Afflict the Cudra woman, the boaster; trouble her, O Takman," etc. This was a counter-charm against magic: "An eagle found thee, a wild boar uprooted thee with his snout; seek to injure the injurer, O herb, smite back the magician."

Use was made of medicinal herbs as well as charms in the treatment of surgical cases, and it sheds a strong light upon the ancient Indian knowledge of wounds to know that the Vedas were familiar with extraction of arrows, with dressing of wounds, artificial limbs, castration, etc. This empirical knowledge was more than a negligible quantity; distinction was made between a number of diseases, amongst which were scrofula, vertigo, dropsy, epilepsy, gout, heart-disease, jaundice, hemiplegia, etc. Amongst the remedies of the Vedas were means of producing abortion and of furthering conception, and, characteristic of Indian medicine, aphrodisiacs.

The greed of gain of the physician, also of other classes, is indicated in the following: "The wishes of man vary: the waggoner desires wood, the doctor sickness, the priest libations."

A physician mentioned in the Rig Veda hopes to get by his cures "horse, cattle, and clothes."

Theurgy was never entirely overcome, and as Indian intellectual life was always held in bondage by theology, so later medical literature makes constant allusion to the Atharva Veda, and may indeed be looked upon as a supplement to this. The accord between the two in nomenclature and in physiological and hygienic views is almost complete.

Religious ceremonies, superstitions, customs, and spells continued unchanged, in association with rational therapeutics, especially in the domain of midwifery and care of children, also in the treatment of the insane.

The Brahmanic epoch is the type and the golden age of Indian medicine. It is of exceptional interest since the later development under Arabic influence on the one hand adds little that is new, on the other is lacking in any national individuality. It is remarkable for a highly-esteemed caste of physicians independent of the priesthood, for a splendid scientific literature, and for a widely developed education and deontology.

The similarity between Indian and Greek medicine of the period is in its outline and in certain details so striking that it is hardly surprising that the originality of the former has frequently been questioned or even denied. The more so is this true since the dates of the more important Indian works are fixed with the greatest difficulty, and before the discovery of the most recent MSS they were quite indefinite.

In consideration of the outstanding independent achievements of the Indians in most branches of science and art, and of their aversion from foreign influences, the trend of opinion to-day, informed by recent discoveries, is in favour of the originality of Indian medicine in its most salient features.

Anatomy, materia medica, dietetics, hygiene were autochthonous, and if theoretical or practical knowledge came to them transitorily from the Greeks it was stamped by the Indians with their own individuality and assimilated.

Medicine lay in the hands of the Brahmans only so long as empiricism, surgery in particular, was obstructed by theurgy. At this time the scientifically instructed physicians belonged to the high mixed caste of Ambastha (Vaidya), who derived their descent on the father's side from Brahmans.

With them was associated a subordinate class of empiricists, assistants, who were included in the less highly esteemed caste of the Vaisya.

Indications of the priestly origin of the medical profession—which was at first identified by the Indians with the descent of the representative of the profession himself from the Brahmans—are to be found in the whole system of instruction and in the ethics of the profession. The former was moulded exactly upon the education of Brahman scholars. The choice of the profession of medicine was conditional upon good descent—preferably from a medical family—manual dexterity and the possession of certain physical as well as moral and intellectual endowments. The mode of life and pursuit of study were most minutely ordered; reverence towards the Brahmans, towards their teachers and their ancestors, was constantly inculcated. The admission of the youth took place in winter, with a waxing moon, upon an auspicious day, in the presence of the Brahmans. The instruction was prefaced by a ceremonial dedication festival, at the close of which the initiate took a vow that he would truly observe the religious duties and the prescribed commands of the profession. No teacher might instruct more than four to six pupils at a time.

The instruction lasting six years was based upon a recognised and proved text-book, and consisted on the one hand in learning by heart precepts which were explained by the teacher, whilst on the other hand there was practical instruction (visiting the sick and training, particularly in surgery).

“He who is only trained in theory but is not experienced in practice knows not what he should do when he has a patient and behaves as foolishly as a youth upon a field of battle. On the other hand, a physician who is educated practically but not in theory, will not earn the respect of better men.” Medicine and surgery had equally to be mastered, since “the physician who lacked knowledge of one of these branches was like a bird with only one wing.” After the studies were completed, permission to practise had to be obtained from the king.

Full of scientific enthusiasm, the physician was enjoined to widen his knowledge through intercourse with his professional brethren, so that the light of wisdom should not be hidden from him. The physician's outer man, his relations with the patient and the patient's friends, his honorarium—all these were regulated to the smallest details. Hunters, fowlers, caste-breakers, criminals, as well as incurables, were not to be treated. More from medical policy than from ethics was derived the counsel not to prescribe for those who were in disfavour with the king. The impression

left upon the national mind by the physician is seen from the saying, "In illness the physician is a father; in convalescence, a friend; when health is restored, he is a guardian."

Improper procedure was punished according to the law: good physicians might, after death, expect the heaven of Indra as a reward.

The centre of medical science lay in the holy city of Benares on the Ganges—also the seat of Brahmanic learning.

The following view was current upon the necessary traits of a scholar suited for the study of medicine and those of a fit teacher:—"The scholar must have a quick tongue, small lips, regular teeth, a noble aspect, well-formed nose and ears, a lively spirit, and a graceful bearing; he must be capable of withstanding pain and fatigue." "The teacher must read aloud from the holy book, step by step, verse by verse, distinctly, but without effort, without hesitation, neither too quickly nor too slowly, not speaking through the nose, showing no trace of impatience," etc. At the close of the initiation ceremony the novice was warned to be chaste and abstemious, to wear a beard, to speak the truth, to eat no meat, to render to his teacher obedience in all things; as a physician he was to treat gratuitously Brahmans, teachers, the poor, friends and neighbours, the pious, orphans, etc.

On certain days, in the dusk, during thunder and lightning, at the time of the king's illness, during great festivals, or convulsions of nature, no study was to be undertaken lest it receive only half attention. "Instruction is to be received with the understanding, not only with the ear, lest the student be like the ass who, bearing a burden of sandal-wood, recognises not its value, but only its weight."

The practice of surgical operations was carried out by showing the student incisions upon fruits, punctures in distended skins, bladders or bags, scarification upon stretched skins with the hair still on, venesection upon the blood-vessels of dead animals or on lotus-stalks, probing in worm-eaten wood or tubular objects, extraction of teeth from dead animals, opening of abscesses upon a lump of wax smeared on wood, sewing in thick clothes, bandaging on figures, cauterising on meat, etc.

In the directions given to the physician on entering into practice it is said: "Let thy hair and thy nails be cut short, keep thy body clean, wear white clothes, shoes on thy feet, carry a staff in thine hand." "Let thy appearance be modest, and thy spirit pure and without guile." On a visit to the dwelling of the patient, the physician should be well clothed, with bowed head, thoughtful, with quiet demeanour, keeping all considerations in view. On entering, words, thoughts, and feeling are to be directed to nothing but the treatment of the patient. There must be no talk of what happens in the house, and no information of the approaching end is to be given where this may be to the prejudice of the patient or of any one else. Particularly is all intimacy with women discouraged, and the physician is warned not to gossip nor jest with them, nor to accept from them any present, unless perhaps it be food.

The medical honorarium varied according to the position of the patient, and at times was very high; the highest attainable position was that of court physician.

In war-time the troops were accompanied by physicians.

The most renowned representatives of the medical literature of India are Caraka, Susruta and Vagbhata—"the ancient trio." The much-discussed problem of fixing the dates of these physicians' lives or of the works attributed to them has only in the light of recent research been definitely

solved. This indicates that Caraka probably lived about the commencement of the Christian era ; Susruta was in the fifth century A.D. looked upon as an author of a far distant past ; and as regards Vagbhata, his genuine work, in which he quotes Caraka and Susruta, can hardly have originated later than the seventh century A.D. Time may possibly reveal how far the extant works represent only later editions of the originals, partly of ancient, partly of more recent origin. It is evidence, however, of the age and importance of medical tradition that Caraka and Susruta looked upon themselves solely as younger elaborators of the ancient Ayurveda (science of life)—directly inspired by Brahma, and consisting of 1000 sections each of 100 stanzas. The supposed mythical origin of this work, which no doubt contains a germ of historical truth, may explain the fulness of knowledge—the product of many generations—and the striking similarity in form and content of both authors. Not alone the system of teaching and the terminology are common to both, but also the interchange of prose and verse. Caraka is characterised by greater circumstantiality of description, Susruta by a more terse treatment of his material, and a fuller consideration of surgery.

All further Hindu writings follow the old masters, and are content to be commentaries upon the original works, and to complete and improve these through fresh experience, without in the least interfering with the theoretical groundwork or the old-time formulæ.

The chief obstacle preventing the growth of a really scientific art of medicine lies in the religious interdiction of every occupation involving contact with a corpse, whereby the study of anatomy was rendered impossible.

Doubtless, the prohibition was now and then overstepped in the interests of surgery, since this necessitates a certain familiarity with anatomy. Bodies were left seven days lying in water, the macerated outer parts scraped with bark and the exposed inner parts inspected. Such a procedure could naturally lead to no real knowledge of the subject, and opened up a field for speculation where speculation was least admissible.

Indian anatomy is no description, but merely an enumeration and classification of the constituent parts of the body ; it is characterised by a juggling with figures wherein the numbers 5 and 7 play chief part. The enormous numerical subdivision of the body is partly accounted for by the above procedure.

The body consists of 6 chief and 56 minor members, the skin of 6 or 7 layers, there are 5 “organs of sense” (hands, feet, arms, genitals and tongue), 5 organs of feeling, 7 reservoirs for air, bile, phlegm, blood and urine, digested and undigested food, in women an eighth for the foetus, 15 inner organs, 9 openings, 10 chief seats of life . . . 107 spots, injury to which is dangerous or mortal, 360 bones, 210 joints, 900 ligaments, 500 muscles. . . . In relation

to the vessels the data vary. In one place 300 veins are mentioned, radiating from the navel, in another 10 chief vessels are supposed to spring from the heart. To be distinguished from these are 24 tubes (nerves) leading from the navel, also other tubes, of which two each are for the breath, food, water, chyle, blood, flesh, fat, urine, fæces, semen, and menstrual blood. As by the Egyptians, vessels, nerves, and cavities of all kinds are confounded. The scant acquaintance with anatomy also explains the lack of definition of bones and muscles in sculpture.

According to the medical theories of the Indians, three elements permeate the body—air, phlegm and bile—and, independently of the soul, carry on the vital processes. The air serves the purpose of movement and is located principally below the navel; the warmth-distributing bile has its place between the navel and the heart; the phlegm, which actuates the organs, above the heart. The three elements bring the seven primary constituents into being, chyle, blood, flesh, fat, bone, marrow and semen. The seven primary constituents correspond to seven impurities. Chyle originates from the products of digestion—which takes place through internal fire—flows by twenty-four channels from the heart through the whole body and changes every five days into the other six constituents in succession. Thus, by a process of development lasting one month, blood is in the first place produced; from blood, flesh; from flesh, fat; from fat, bone; from bone, marrow; and from marrow, seed. The quintessence of all seven substances constitutes the vital force which, conceived as a delicate, oily, white, cold material, permeates the whole body and regulates its functions.

Air (wind) preponderates in the old, bile in middle age, phlegm in childhood. The same relationship governing the predominance of one or other of the elements holds good for the beginning, middle and end of the day, of the night and of the periods of digestion. The preponderance of one or other element also influences character and temperament. Varieties of each were recognised; thus 5 forms of air, 5 of phlegm, 5 of bile. It is noteworthy that many authors—analogy with the Greek humoral theory—look upon the blood as a fourth vital element on account of its preponderating importance. It may here be mentioned that the teaching of the four vital elements occurs in the sayings of Buddha.

Health is an expression of a normal composition of, and a normal quantitative relation in the elementary substances; if these or the primary constituents are deranged, abnormally increased or decreased, disease ensues.

In the classification of diseases, a large variety of which were described, the teaching concerning the elementary substances and primary constituents finds expression; but not exclusively, since other considerations, partly religious and speculative, partly empirical, played their part as principles on which a classification was founded. Such were:—ætiological

considerations (natural causes of disease, such as faulty mode of life or nourishment, climate and weather, psychical affections, heredity, poison, plagues or supernatural influences, wrath of the gods or demons, and "Karma," which in the Indian reincarnation creed follows errors in a previous existence); the position of the disease (inner, outer, local, general, bodily, mental); the curability (curable, to be alleviated, incurable). At bottom, however, the vulnerable point is always air, phlegm, bile, blood or one of the other elements and according to the involvement of one or several of the elementary substances, the numerous severe or mild disease-forms are produced.

According to Susruta there are 1120 diseases, according to Caraka an innumerable quantity. The latter enumerates 80 wind-diseases, 40 bile-diseases, and 20 phlegm-diseases (the enumeration is not, however, complete owing to the origin of a number of affections from accidental or external causes, *e.g.* injuries of all sorts, lightning, sunstroke, demoniacal influence, etc.). He distinguishes between three main groups, natural, mental, and demoniacal diseases.

Susruta divides diseases into "bodily," those due to injury, those caused by mental disorder, and "natural ills" (those incidental to old age, inanition, congenital ailments).

Vagbhata distinguishes "natural" and mental demoniacal ailments, in the former of which disorder of the elements is the primary, in the latter only a secondary cause. The particular element affected is to be known from the symptoms.

In addition to these already mentioned Susruta has another division into seven classes:—

1. Hereditary; 2. congenital; 3. those originating from the primary elements; 4. those due to injury; 5. those due to influence of the weather; 6. those due to demoniacal influences or infectious contact; 7. those due to hunger, age, etc.

Certain diseases are due to Karma (*e.g.* the murderer of a Brahman suffers from anæmia, the adulterer from gonorrhœa, the incendiary from erysipelas, a spy loses an eye, elephantiasis is the punishment for unchastity).

Such patients have to undergo expiation ceremonies and penances; where severe ailments develop from slight causes a conjunction of Karma with disordered body humours is to be recognised.

From a medical point of view there may be deduced from this mysticism a recognition of the fact that ordinary ætiology frequently fails in the explanation of disease.

Plagues were supposed to originate from droughts, floods, influence of the stars, exhalations etc. or as punishments of the gods.

Diagnosis of disease was confined within the boundaries of scientific dogmatism, but was founded upon carefully collected evidence of the senses.

The Indian physician employed not only inspection, palpation and auscultation, but even pressed taste and smell into the service of medicine. With the eye were perceived increase or decrease of body-weight, the appearance of the skin, of the tongue, of the excretions, the shape and size of swellings; with the ear attention was paid to alterations in the voice, to the sound of the breathing, cracking of the joints, crepitation of broken bones, rumbling of the bowels. With the sense of touch were perceived the temperature, smoothness and roughness, hardness or softness of the

skin ; taste gave information upon the state of the urine (sweet taste in diabetes), smell upon the nature of exhalations.

All these methods of investigation assisted the anamnesis which had been derived from careful interrogation concerning the family history, habits, duration of the illness and subjective symptoms of the patient.

In the later works diagnosis appears more subtle but also more dogmatic as *e.g.* when, from the state of the eyes, tongue and urine, wide reaching and speculative conclusions were drawn upon the ætiology and seat of the disease. Probably as a result of foreign influence, great stress was laid in Indian medicine of more recent times upon examination of the pulse. This was felt, in women on the left, in men on the right side ; the physician laying the three middle fingers of the right hand upon the artery, noticed the compressibility, rate, rhythm and volume.

Affections caused by air betray themselves by a creeping pulse—like a snake or leech—; a pulse jumping like a frog, crow, or quail indicates the prevalence of bile ; one which meets the finger slowly—like a peacock, a swan or a dove—points to phlegm.

Characteristic pulses are described for most illnesses.

Prognosis was most fully developed, and the nature of this shows clearly the connection which is indisputably proved by history to exist between the priestly cult of omens and medical prediction. Thus Indian prognosis displays on one side wonderful perception and power of observation, whilst on the other it literally abounds in evidence of primitive superstition.

In this connection may be indicated their belief in dreams and in the ominous influence of purely fortuitous occurrences previous to visiting a patient.

Medical policy early demanded guidance as to the probable general course of a disease and its curability or incurability—in the latter case treatment was to be withheld—also as to the nature of the patient and its probable influence for good or evil upon the treatment (*e.g.* heroic measures, often the only successful ones, were unsuitable for rulers, old men, children, and women. Failure to follow the directions of the physician through avarice, poverty, or stupidity rendered his activity useless and cure impossible).

Before undertaking treatment it was considered most important to obtain some information upon the vital power of the patient ; longevity was deduced from certain signs, *e.g.* from the large size of the hands, feet, teeth, forehead, ears, shoulders and nipples, from a deeply-lying navel, etc. Short fingers and a long sexual organ were considered indications of short life.

The Indian authors describe in detail the foretokens of death and prognostic symptoms, both in general and for each particular complaint. Accidental occurrences or mental changes in a patient were recognised

as having a meaning in this respect, such were, delusions, delirium, insomnia or heavy sleep, anæsthesia or sudden paralysis, sudden fall of temperature, sweats, prominence of the veins, dyspnoea, difficulty in moving, dryness of the tongue etc.

It counted as a happy omen if the messenger sent to fetch the physician was clean, dressed in white, of the same caste as the sufferer and came riding in a waggon drawn by oxen. It was inauspicious if the messenger was of a higher caste, a eunuch or a woman, himself sick, sad, or afraid, if he ran, wore shabby or dirty clothes, rode an ass or a buffalo, came at midnight or midday, at a time of an eclipse of the moon, or if he arrived when the physician was asleep, lay unclothed upon the ground etc. Good omens were: accidental encounters upon the road with a maiden, a suckling woman, two Brahmans, a running horse etc. Bad were a snake, oil, an enemy, a one-eyed man etc.

As instances of prognosis in individual affections may be given these:—diabetes was considered fatal when dangerous abscesses occurred; “hæmorrhoids” were so considered in presence of swelling of the mouth, feet, testicles, navel and anus, if the loss of blood was severe, if thirst, loss of appetite, colic and fever occurred.

Particularly severe illnesses with unfavourable prognosis were: ascites, leprosy, gonorrhœa, hæmorrhoids, fistula, abnormal presentations of the child, lithiasis and tetanus.

In the treatment of disease hygiene and diet were considered as at least of equal importance with drugs and more strictly therapeutic measures.

It is a natural sequence that the Indians under the influence of a religion which orders the whole course of life by social and hygienic rules down to the smallest details, should in health practise personal cleanliness more assiduously than all other nations and should take much thought over a proper dietary. Religion and medicine are, in respect of hygiene, in complete accord, as may be seen in the agreement of their directions relating thereto. An exception is to be found in the fact that the consumption of meat and alcoholic drink, forbidden by religion, was not so by medical authors.

The precepts relate to the following:—

a. Daily ablution, regulation of the evacuations, cleansing of the teeth by means of fresh sticks which had to be taken from the branches of certain trees and had a bitter and astringent taste, scraping the tongue, rinsing out the mouth, washing the face, application of salves to the eyes, anointing the body with aromatic oil, oiling the head, ears and soles of feet, care of the mouth (with betel-leaves, camphor, cardamoms and other herbs), care of hair, beard and nails (the latter were to be cut every five days).

b. Meals and diet. Two meals a day between 9 and 12 a.m. and 7 and 10 p.m., with previous stimulation of the appetite by means of salt and ginger, directions as to the articles of diet, sitting at meals, sequence of dishes, moderate drinking at meals (water-drinking at commencement of meals tends to thinness by delaying digestion, copious drinking at the end of meals to stoutness), careful hygiene of the mouth after meals, a short walk. The most important articles of consumption were: the various cereals, particularly rice, fruits, vegetables, nuts, ginger, garlic, salt, water (rain-water the best), milk, oil, butter, honey, sugar-cane. Of meats the best were considered to be game, birds and buffalo-meat; less wholesome were, pork, beef and fish; the amount of food was to be regulated by the capacity of the digestion.

c. Exercise and rest, massage, baths and clothing, gymnastics, sleep (by day only after great exertion, by night until an hour before sunrise). Warm and cold baths (the most sacred in the Ganges), a daily bath (considered harmful after eating, with a chill, with a cold fever, diarrhœa, disease of the eyes or ears), warm bathing or washing was good only for the

lower half of the body, for the upper it was harmful, sea-water and medicinal springs. Clothes must be clean, dirty ones caused skin-diseases ; it was advisable to carry a stick and to wear a hat and shoes. Wearing garlands, ornaments and jewels strengthened the vital power and warded off evil spirits.

d. Regulation of sexual intercourse (milk was to be drunk after it) forbidden on the 8th, 14th, and 15th days of the month and in the morning.

e. Prophylactic measures : an emetic once a week, a laxative once a month, twice a year venesection. The dietetic hygienic regulations varied naturally with the season, no little attention being paid to climatic conditions.

The purposeful regulation of nourishment and digestion always preceded the more directly remedial measures, amongst which cures by the administration and withdrawal of food played no small part ; whilst external applications (baths, inunctions, plasters, fomentations, fumigations, inhalations, gargles, sternutatories, instillations, enemata, suppositories, urethral and vaginal injections, bleeding etc.) were extremely popular. Under the name of the " five procedures " were united the most important methods of treatment, viz. emetics, purgatives, enemata, oily enemata and sternutatories, the use of which was preceded by fatty applications and diaphoretics. The indications were numerous and given in detail.

As an aid to emesis the patient pushed a twig from a castor-oil plant down his throat whilst a servant held his head and sides ; it was the duty of the physician to examine the vomit.

The apparatus for administration of an enema consisted in a clyster-bag (an animal's bladder or leather bag) and pointed metal, horn, or ivory tube. Accidents appear not infrequently to have happened in its use.

Nasal medications, which were considered specially suitable for head and throat ailments, served partly for clearing the head, partly for strengthening it ; a drug or medicated oil was introduced into the nostrils or snuffed up into it drop by drop.

Fats and oils, either alone or with additions, were employed externally or internally. Diaphoresis was induced by means of cow-dung or sand heated in a cloth, or by means of steam baths (in a cask, in a hot room, heated by a stove with holes in it, lying on a heated stone slab, burying a jar with medicaments and red-hot stones in it under the bed of the patient ; application of tubes, one end of each being in a steam kettle whilst the other was approximated to the diseased part etc.).

For inhalations the following procedure was employed : the medicament was powdered, kneaded into a paste and spread around a hollow stalk. When the paste dried the stalk was drawn out, the resulting tube of paste put into a tube of metal, wood, or ivory, set alight at one end, and the other placed in front of nose or mouth.

The means of withdrawal of blood were leeches, cupping, scarification or venesection. Detailed prescriptions are given for the preservation and application of leeches. For cupping use was made of a cow's horn at the point of which a piece of cloth was bound, or of a hollow flask-shaped gourd in which a burning wick was placed. Venesection was performed with a lancet, very careful indications and contra-indications being laid down, also touching the choice of spot (according to the position of the disease, from the veins of the forehead, nose, angle of the eye, the ear, breast etc.). The patient was previously anointed, whilst during the operation a servant held him up by means of a cloth wrapped round the neck.

The pharmacopeia, corresponding with the fruitful nature of the land, was a rich one and stamps Indian medicine with a character entirely its own, whilst nothing speaks more eloquently for its originality than the fact that of all the many medicinal plants no single one was European. The overwhelming majority of therapeutic substances were of vegetable origin ; Caraka was familiar with 500, Susruta with 760 healing plants (roots, barks, juices, resin, stalks, fruits, blossoms, ashes, oils, thorns, leaves etc. being used). No small number of animal substances, however, and, more surprising, also of mineral substances, were employed. Mineral drugs were used by the Indians at quite an early stage, not only externally, but internally, and it was these to which the greatest efficacy was ascribed.

From India many medicinal plants or drugs came to the West, such as spikenard, cinnamon, pepper, sesame orientale, cardamoms, cane-sugar etc. Of animal substances may be mentioned blood (as a strengthening agent), bile, milk (human, cow's, elephant's, camel's, ewe's, mare's), butter (a very favourite ingredient), whey, honey, fat, marrow, meat, skin, spermatic fluid, bones (goat's bones for salves), teeth, sinews, horns, claws, nails, (fumigations against malaria), hair (burnt for skin injuries), gall-stones (of the ox), urine (of the cow), fæces (cow-dung for inflammation, elephant's for leprosy). A high reputation was enjoyed by mineral substances : (metals, amongst which were gold, copper sulphate, sulphate of iron, oxide of lead, sulphate of lead, litharge, sulphur, arsenic, borax, alum, potash, salt, ammonium chloride, precious stones etc.). The preparation of the mineral substances presupposes a surprising chemical attainment. Gold was purified by being beaten into thin leaves, seven times heated and sprinkled with various fluids ; oxidised it was recommended as a stimulant, aphrodisiac or elixir of life. Other metals were similarly treated.

As regards quicksilver, it was only mentioned a few times in the older literature, and before the Mahomedan era the metallurgical processes necessary to its therapeutical employment were not known. Later it was one of the favourite remedies (for skin diseases, fever, nervous or pulmonary diseases, syphilis and for the lengthening of life)—the "King of metals" and a proverb says :—"The physician who understands the healing powers of roots and herbs is a man ; he who understands the waters and fire, a demon ; he who understands the efficacy of prayer, a prophet ; he who understands the virtues of quicksilver, a god." As the Indians accomplished much in the domain of chemical technology, trade in pharmaceutical products flourished, and their number was great. Extraction of juices of plants by maceration was known, together with infusions, decoctions, electuaries (the materials being boiled down and thickened with oil, butter, honey, etc.), mixtures, syrups, pills, pastes, suppositories, powders, drops, collyria, salves, fumigatories etc.

The doses were measured by native weights (seeds of *abrus precatorius*).

Most of the recipes were highly complicated, and adorned by full-sounding titles such as "Ambrosia of melted butter," "Lemon pills of Asvin."

The physicians were expected to seek their drugs themselves, and to take advice from shepherds, hermits and hunters. They carried a species of travelling or domestic medicine chest. Susruta gives directions as to the best situation, as to the season and manner of collecting the plants and also as to the locality where the medicines are to be prepared—situations sheltered from smoke, rain, wind and damp. Mysticism naturally did not go empty-handed any more than the quackery masquerading in its guise. Prayers and incantations had to precede pharmaceutical procedures ; medicaments collected and prepared by laymen counted as useless.

Medicaments were classified according to the diseases for which they were efficacious, and according to their actions (*e.g.* emetics, purgatives, laxatives, sedatives, tonics, aphrodisiacs etc.).

Thus Caraka has fifty groups. Other grounds of subdivision were general characteristics, such as their elementary constitution, their taste (sweet, sour, salt, sharp, bitter, astringent), their changeability (during the process of digestion), their quality, heating or cooling, softening, drying, cleansing, making smooth.

A bright light is thrown upon Indian culture by the fact that cosmetics (*esp.* hair dye), elixirs of life (increasing power and personal beauty), aphrodisiacs, poisons and antidotes (also universal antidotes) occupy a prominent position.

In a land where childlessness counted as one of the greatest misfortunes, and impotence caused loss of inheritance, aphrodisiacs, in addition to dietetic and suggestive measures (song, music, and flowers), were naturally in great request. In the literature they are frequently mentioned; of one consisting of sesame, beans and sugar Susruta says: "Vir hac pulve comesa centum mulieres inire potest." A place of even greater importance is occupied by poisons and antidotes; on account of the frequency of poisoning, the physician had to be accurately acquainted with these; undoubtedly the Indian physicians were renowned for their art in the treatment of snake-bite. In particular was it the duty of the court physician to guard the king from poisoning, whence the inspection of the kitchens fell to his lot. By experiments on animals (*e.g.* on different birds, on monkeys or flies) it was determined whether a dish were poisonous or harmless. The poisoner was to be recognised by his speech and gestures.

The literature contains the most minute descriptions of the symptoms of poisoning from vegetable or mineral substances or from the bite of venomous animals (snakes, tigers, monkeys, mad dogs, rats, mice, fish, lizards, scorpions, flies, spiders etc.). Attention is also drawn to the signs indicating slight or severe cases and the stage of the poisoning. In the treatment rational procedures were employed as well as magical formulæ, prayers and music (*e.g.* cold water, sternutatories, cupping, blood-letting, constriction of a limb above a wound, sucking the wound with the lips protected by bladder, extirpation, cauterisation). Amongst the favourite antidotes were: *nymphæa odorata*, *brassica latifolia*, *aconitum ferox*; also various compounded specifics such as that out of the five salts, long and black pepper, ginger and honey, used internally or as a snuff.

The nature of the Indian "poison-woman," intercourse with whom caused death, is so far unexplained.

The multitude of medicaments which empiricism had collected conduced the more to polypharmacy since the prevailing beliefs assumed the existence of a mass of independent disease entities. Thus there were described 26 varieties of fever (of which 7 depended upon the disturbance of one, 13 upon that of several of the fundamental humours, 1 upon injury or other external cause, and 5 belonged to the category of malarial fever), 13 varieties of abdominal swelling, 20 worm diseases, 20 forms of urinary complaints. One of the last was diabetes mellitus, first described by the Indians, who noticed that flies and insects sucked up the sweet

urine ; 8 forms of strangury ; 8 varieties of jaundice ; anæmia (treated with iron preparations) ; 5 varieties each of cough, asthma and hiccough ; 18 forms of "leprosy" (under which designation widely differing forms of skin-disease are included) ; 6 kinds of abscess ; 4-7 kinds of impotence ; 5 kinds of fistula in ano ; 15 varieties of ulcers ; 76 eye-diseases ; 28 ear affections ; 65 mouth ailments ; 31 diseases of the nose ; 18 of the throat, besides a number of mental diseases etc.

It should here be borne in mind that each of these so called diseases was nothing but a vague symptom-complex, which, upon the slightest deviation from its supposed type, dissolved itself to reappear in a number of fresh categories. In many of the named diseases, however, in addition to the ætiology and symptomatology which were observed with wonderful care, in addition to the doctrinaire origin of fundamental principles, here and there anatomical considerations show themselves.

For instance, a variety of abdominal swelling was designated "Spleen-belly," depending as it did upon enlargement and downward displacement of the spleen ("which, hard as a stone and rounded like the back of a tortoise, fills up the left side")—similar symptoms on the right side are designated "Liver-swelling."

The natural consequence of so localised a pathological conception was—a localised method of treatment.

Accuracy of observation characterises the description of the varying constitution of fæces and urine, that of vertigo, of skin-diseases, of venereal affections, apoplexy, epilepsy, hemicrania, tetanus, rheumatism, insanity etc. In cholera were prescribed emetics, warmth to the body and the cautery, followed by asafoetida with astringents or opium with white pepper. Small-pox is undoubtedly indicated by Susruta but is only later accurately described. The cult of the small-pox goddess and "the small-pox sisters" is also of later origin. There is no trace in the older literature of any inoculation having been performed.

Fever was placed upon a level with the most important primary phenomena and traced to the most diverse causes. At the commencement the patient had to observe a rigid diet (thin broths, warm water), or else to fast: particularly to be feared was that fever which originated from a disturbance of all three primary elements—it assumes a dangerous character on the 7th, 10th or 12th day, when it either ceases or causes death.

The varieties of malaria were explained by the supposition that in quotidian fever the flesh, in tertian the fat, and in quartan the marrow and bones were involved. The seven constituent parts of the body corresponded to as many varieties of fevers—fever in the spermatie fluid is mortal.

As in other illnesses so in fevers various stages were recognised (unripe, ripening and ripe)—according to the predominance of certain symptoms.

Under the title "worms" were described thread-worms and occasionally tænia, but for

the most part quite other things, seen or imagined, as the cause of disease. The Indians, like the Babylonians and Egyptians, made "worms" responsible for many ailments and thus believed in eye, tooth, ear, head, heart and other worms. The case of a patient suffering from giddiness and presenting the six symptoms, cough, diarrhoea, pain in the side, hoarseness, loss of appetite and fever, or the three: fever, cough and hæmorrhage, was not to be undertaken by any physician seeking reputation.

"Leprosy," amongst other causes, was supposed to be due to the frequent consumption of fish with milk.

In the Indian writings after the sixteenth century A.D. syphilis is always described as "the disease of the Franks" and external, internal and mixed forms are described. Treatment was by mercury, internally as a pill with flour, as fumigation, as inunction—and sarsaparilla.

The treatment of the insane was partly bodily, partly psychological. Mention is made of enlivening the patient by cheerful talk, but mostly barbarous means were employed (such as starvation, burning, whipping, imprisonment in a dark room, frightening with snakes, lions, elephants, threats of death etc.). The severer forms of insanity were regarded as possession and it was sought, from the behaviour of the patient, to deduce which of the numerous demons had him in its grasp.

Surgery constituted the summit of attainment of Indian medicine and although looked upon as *ultimum refugiens* it yet commanded an elaborate technique and was from its nature removed from the influence of speculation. The care and cleanliness which already distinguished the Indian physician in general was of particular value in this subject and assured a measure of success in many branches, which for long remained beyond the reach of other nations.

Surgical operations fall into eight categories: excision (tumours, foreign bodies), incision (abscesses), scarification (inflammation of the throat), puncture (hydrocele, ascites), probing (fistula), extraction (foreign bodies), expression (abscesses), stitching (with threads of flax, hemp, sinew or hair).

The instrumentarium contained, according to Susruta, 101 blunt and 20 sharp instruments. To the former belonged various pincers, forceps, hooks, tubes, sounds, catheters, bougies etc., also a variety of accessory instruments, such as the magnet (for the extraction of foreign bodies), cupping-horns, clyster-bags etc. "The most important aid, however, is the hand, since without it no operation can be performed." Amongst the sharp instruments are included knives, bistouries, lancets, saws, scissors, trocars, needles etc.

The instruments were fashioned in steel, the manufacture of which the Indians had understood from very early times, and were kept in wooden boxes.

Cauterisation (particularly with potash) and burning (with actual cauteries of varying shapes and with boiling fluids), were preferred to cutting. "Burning is even more efficacious than cauterising since it heals diseases incurable by medicines, instruments and caustics and because the diseases cured by it never return." Splenic enlargements were treated by the insertion, into the parenchyma of the spleen, of red-hot needles.

Of dressings, there were fourteen varieties, named according to their structure; the materials used were: cotton, wool, silk, linen; splints were made of bark, pieces of bamboo and other trees.

Arrest of bleeding was brought about by herbs, cold, compression, and hot oil. Certain wounds were sewn (those of the head, face and windpipe). Operations took place only under

auspicious constellations, were begun and ended with religious ceremonies: the surgeon had to turn to the west, the patient to the east. Narcosis was brought about by intoxication.

Surgical treatment was founded upon a rich experience which showed itself in bold interference, accurate diagnosis, and, not least, in thoughtful after-treatment. The treatment of fractures, (crepitation being recognised as among the signs), dislocations, tumours, (extirpation), fistulæ (division or cauterisation), removal of foreign bodies (fifteen methods), the performance of paracentesis in dropsy etc., all rested upon rational considerations and upon a firm foundation of knowledge. The most astonishing performances of the Indian surgeons, however, were in the domains of laparotomy, lithotomy, and plastic operations.

Suture of the intestines was thus described: to perform the operation the surgeon is to clean the injured parts of the intestine and to allow it to be bitten by black ants. The bodies are then to be torn off, leaving the heads embedded.¹

Vesical calculi were removed by lateral section: "The stone being brought below the navel, the physician introduces the index and middle fingers of the left hand, the nails being cut, into the rectum of the patient until he feels the stone. He then brings it between the anus and the urethra and presses on it until it stands out like a knot. Then follows the incision with a knife on the left side, the breadth of a grain of wheat from the raphe, under certain circumstances also upon the right side, according to the size of the stone."

The chief opportunity for plastic surgery lay in the fact that cutting off nose and ears was in vogue as a legal punishment. Susruta says of plastic surgery: "If the nose of any one be cut off, the surgeon shall take a leaf from a tree of the same size, lay it on the cheek and take out a piece of skin and flesh equally big, stitch the cheek with needle and thread, scarify the stump of the nose and quickly but carefully place the piece of the cheek over it, attach it with a proper dressing, and sew the new nose firmly on. He shall then carefully insert two tubes, in order to make breathing easier and when thus raised he shall sprinkle it with oil and scatter on it red sandalwood and other hæmostatic powders whilst white cotton is laid carefully thereon and it is frequently sprinkled with sesame oil."

As far as ophthalmic surgery is concerned, treatment was here also fairly practical:—the lens was looked upon as the seat of vision, but the description by Susruta of the operation for cataract leaves much to be desired in the matter of clearness.

Of obstetric manipulations, Cæsarian section after death and embryotomy were practised; combined version was unknown. The directions concerning the diet of pregnant women, care of the lying-in and of the newly-born, are worthy of note.

The view of the embryo is that it is the product of the semen and the menstrual blood and both originate in the chyle. In the third month commences the differentiation into the various parts of the body, legs, arms and head; in the fourth follows the distinct development of the body parts and heart; in the fifth are added the flesh and blood; in the sixth are developed hair, nails, bones, sinews, veins and in the seventh month the embryo is

¹ Cf. the chapter on Primitive Medicine.

furnished with all that is necessary for its existence ; in the eighth the vital force is drawn, now from mother to child, now from child to mother ; on account of this to and fro movement a child born in this month is not viable. The hard parts of the body are derived from the father, the soft from the mother. Nourishment is carried on through the vessels which lead chyle from the mother to the embryo. During pregnancy, the foetus occupies the uterus, turned towards the mother's back, the head up, the hands folded across the forehead, lying on the right side of the mother, if of the male, on the left side if of the female sex ; before birth, version occurs.

The uterus is in the shape of a fish's mouth.

The most favourable time for conception is in the twelve nights following the onset of menstruation. Since the sex of the child is dependent upon the preponderance of seminal or menstrual fluid and the latter increases in amount on odd days, the child is male if conception occurs on an even, female if on an odd day (after menstruation). During pregnancy, supposed to last on an average ten months, a careful dietary was enjoined and fright was in particular to be avoided. In the ninth month the pregnant woman betook herself, with religious ceremonial, to the well-appointed house of delivery. Four women assisted at the birth, when a variety of religious and suggestive usages were employed to expedite delivery. Delay in the expulsion of the placenta was sought to be overcome by external pressure, shaking and emetics. Lying-in women got up on the tenth day, but had to diet rigidly for six weeks. The child was put to the breast on the third day (before this it was given honey and butter). If a nurse replaced the mother she was first carefully examined by the physician, and subjected to the most practical dietetic rules. The care of the suckling is regulated with extraordinary detail (*e.g.* nourishment, lying, sitting, sleeping, playing etc.) and in particular a host of customs refer to the exorcism of the demons so dangerous to childhood. Weaning took place in the sixth month, feeding with rice being begun.

Treatment of distocia did not stand so high as the rest of medicine, magical procedures playing their part here also. Contracted pelvis was unknown, also combined cephalic and podalic version. Incomplete foot and breech presentations were treated by bringing down the other foot or feet. Gynæcology was similarly defective.

Indian medicine was in possession of an imposing treasure of empirical knowledge and technical achievement ; it reached to the height of a systematising, theorising school of thought, but it lacked the freedom of individual action essential to the pursuit of real science ; it lacked too unprejudiced judgment and the possibility of criticism, not stopping short even of venerated doctrines. In the strange repressive cultural conditions is rooted the destiny that was to cut short the process of evolution and to lead to scholastic petrification. No new era has dawned for this middle age ; as in the long-silent past so even to-day the edifice of Indian medicine stands unaltered, lonely, apart, far from the everflowing stream of progress. Nevertheless, the collecting, thinking, striving of the Indian physicians has not passed without leaving a trace ; as was the case with their numerals, their fables and tales, their philosophic and religious ideas, their medicine has found its way east and west along the paths of commerce.

Even if they are not always plainly visible, links can still be found uniting the medicine of India with that of her more fortunate sister, Greece. Through

the instrumentality of the Arabs many of the Indian discoveries were carried far into the West, whilst it is to Indian influences that Asia, so far as the sway of Buddhism extends, owes more or less of her medical lore.

That Greek medicine adopted Indian medicaments and methods is evident from the literature. The contact between the two civilisations first became intimate through the march of Alexander, and continued unbroken throughout the reign of the Diadochi and the Roman and Byzantine eras. Alexandria, Syria and Persia were the principal centres of intercourse; Indian physicians, means and methods of healing are frequently mentioned by Græco-Roman and Byzantine authors, as well as many diseases, endemic in India, but previously unknown. During the rule of the Abbasides, the Indian physicians attained still greater repute in Persia, whereby Indian medicine became engrafted upon the Arabic, an effect which was hardly increased by the Arabic dominion over India. Indian influence, in the guise of Arabic medicine, was felt anew in the West. The apparently spontaneous appearance in Sicily in the fifteenth century of rhino-plastic surgery bespeaks a long period of previous Indo-Arabian influence. The plastic surgery of the nineteenth century was stimulated by the example of Indian methods; the first occasion being the news derived from India, that a man of the brick-makers' caste had, by means of a flap from the skin of the forehead, fashioned a substitute for the nose of a native.

India must also be credited with at least an indirect influence upon the spread of hypnotism, as the empirical practice of suggestion was there more developed than elsewhere. To mention only one fact it was certainly no accident that it should have been in Calcutta that the English surgeon Esdaile hit upon the idea of performing numerous operations under *anæsthesia* induced by hypnotism.

The care of the sick received a powerful impulse through the Buddhists, who fostered the art of healing, less from scientific than from philanthropic motives and who spread abroad Indian methods under the flag of religious propaganda (hospitals or institutions for medical consultations and the preparation of drugs were erected).

The oldest colony was Ceylon; the most marked influence was produced upon the medicine of Thibet, and similarly the Indian archipelago (Java), further India (Cambodia, Burma) and even China did not remain unaffected.

MEDICINE OF THE CHINESE AND JAPANESE

THE medicine of the Chinese, independent of any recorded external influences, presents the same picture to-day as thousands of years ago, a rare example of the petrifying effect of time. Withdrawn from the current of progressive development it enables us by actual present-day observation to fill in the gaps in our construction of ancient oriental medicine with which, in its main features, it corresponds.

The distinctive civilisation, developed in harmony with the national type and sprung from peculiar geographical and historical conditions, imparts to Chinese medicine those characteristics likewise to be found in all other departments of Chinese intellectual life. Such are exclusiveness with the blindness of superiority, unreasoning belief in authority and exaggerated reverence for the past, childish pedantry and the subtlest formalism leading, as a necessary consequence, to intellectual stagnation. These are associated with a strange blending of the greatest intellectual barrenness with the weirdest fantasy, of practical observation and clear insight with lack of appreciation of higher abstraction.

In the consideration of their civilisation, which is, in its way, most remarkable, allowance must be made for the fact that, as a nation, the Chinese altogether lacked the advantage which was so great a factor in the development of the Mesopotamian, Egyptian and Aryan civilisations, and of the European which was founded upon these—viz. continual international traffic, constant stimulus and refinement through new ideas and many-sided diversification.

The commencement of morals and culture were, no doubt, derived in prehistoric times by the Chinese from the West, if the hypothesis be correct that they share a common origin with the Aryans and Sumerians. Having once settled down in their immense empire they remained almost entirely isolated from the current of civilisation in western Asia, meeting on their way only nations in a lower stage of development whose history became amalgamated with theirs.

The medical literature is extraordinarily rich. A series of pioneer works is undoubtedly of a great age, if this is not as great as is claimed for them. Immense industry and subtle sagacity characterise most of the medical writings, originality is only to be found in those coming down to the tenth century A.D. : from this time forward the authors content themselves with the rôle of critical compilers and commentators. The greater number of the works treat of medicine in general, have as introduction a historical review, and devote the greater part of their space to the state of the pulse in various diseases on the one hand and to therapeutics on the other. Besides these there are also specialised writings, *e.g.* on the pulse, or on a definite group of diseases (women's, children's etc.).

To give the subject a lighter touch some authors treat it in verse.

The hallowed edifice of medical learning built up by the Chinese is an example of a strictly self-contained, close system which unites empirical attainments into an harmonious whole free from all internal contradiction, permeated by a rigid method of thought.

A marvel of formalism, a caricature of real science, it owes such advantages as it possesses not to the objective truth of its content, but to the circumstance that its premises have their origin in the prevailing cosmic theory, and thus beyond all criticism, they are ensured lasting recognition and even possess the significance of incontrovertible axioms. In the light of occidental conceptions this flower of scientific romance withers rapidly and it is to be feared that even unbiassed historical analysis robs it of much of its colouring.

The main idea of this scheme is drawn from the fantastic, grandiose Chinese natural philosophy, which for centuries has held the entire intellectual life of the nation in bondage and has forced empirical research to tread slavishly in the path marked out by a stultifying, high-enthroned system of speculation. It may be epitomised in the statement that the human body with its powers is, to the minutest details, the reflex of the phenomena of nature in the universe; that numerous analogies exist between macro- and microcosm and between the various constituent portions of the body themselves, whose mutual interaction explains the entangled web of cross and counter influences. In the thraldom of this idea and under the sure conviction that the discovery of these analogies furthered the understanding of vital processes, both normal and pathological, in every case, the medical thinker saw in the speculative investigation of these mysterious associations the only goal worth striving for, whilst to empiricism fell the task of endorsing, where possible, these barren doctrines, never of correcting them.

Under such conditions it was above all impossible that that particular branch of science—*anatomy*—should advance, whose development is bound up with free and unbiassed research. How should it flourish, when its every step—apart from religious views which forbade human dissection—was hemmed in by speculative preconceptions? *Anatomy* which, instead of being a corrective, is but a prop to hypothetical assumptions, can only be a caricature; such is indeed the Chinese teaching concerning the structure of the human frame; a phantasmagoria containing little more than a few salient facts arrived at by chance.

According to religious belief whoever enters the realm of death with a mutilated body cannot look forward to a reunion with his ancestors. Hence even the parts of the body removed in operation were kept and after death placed in the grave. Post-mortem dis-

section was incompatible with piety and was held an injury to the dead and unfitting on the part of the living. Only in rare cases was it considered permissible to make an exception with the bodies of malefactors. Such occasional breaches of religious prohibition in ancient days, or more frequently the observation of executed criminals or severe injuries, may have constituted the source of the superficial knowledge of the shape and position of the viscera; osteology, also, may have derived advantage from the fact that all the remains of the dead were carefully preserved. Dissection of animals does not seem to have been undertaken for purposes of comparison.

The anatomical descriptions of the Chinese are, owing to their turgid nomenclature, frequently difficult of interpretation; they concern, since the purposes of practical medicine are alone taken into consideration, mainly the viscera and circulatory system. The anatomical pictures accompanying the topical writings would have been of assistance if they had not been, on account of their uncouth design, so untrue to nature.

According to the Chinese representation the number of bones was 365; the skull, forearm, leg and pelvis all counted as one bone each. No accurate knowledge seems to have existed upon the muscular or nervous system nor upon the organs of sense. The remarkable statement was made of the brain that it occupied only a small space in the cranium; the spinal cord was considered to end in the testicles. The heart, into which the larynx was said to open, was compared with the flower of a water-lily; it possessed seven orifices and three divisions, and rested upon the fifth vertebra. The lung lies upon the third vertebra, has eight lobes and is pierced by eighty small holes: the liver has seven lobes and lies upon the ninth vertebra. The gall-bladder is likened to a wine-bag; the spleen lies on the eleventh vertebra; the small and large intestines have sixteen convolutions; the bean-shaped kidneys are dependent from the fourteenth vertebra. Besides the above organs, to which must be added the description of the stomach and of the bladder with the urinary passages, Chinese anatomy recognised a hollow organ, divided into three parts without which the viscera could not carry on their functions. It was known as *San-tsiao* and may possibly be identified with the peritoneum or pleura. The course of the vessels was quite fantastically represented.

The attempt of the Emperor Kang-Hi (1662-1723) to introduce Western anatomy—he caused a translation to be made of the anatomy of Pierre Dionis by the Jesuit P. Perennin—was frustrated through the opposition of the native doctors. From the nineteenth century onwards reproductions have been made in China of European anatomical illustrations, but so far no deep impression has been made upon prevailing views.

Touching embryology the following beliefs are current: in the first month the fœtus resembles a drop of water; in the second a peach leaf; in the third the sexes are differentiated; in the fourth the embryo takes on human shape; in the fifth bones and joints can be distinguished; in the sixth, hair. If it is a boy the right hand moves on the left side of the mother's body at the end of the seventh month, if a girl the left hand on the right side at the end of the eighth. At the end of the ninth month three changes can be made out in the position of the fœtus by external palpation; at the end of the tenth month development is complete. The duration of pregnancy is 270 days. The sex of the child may be determined by the maternal pulse: if the right one is augmented it signifies a boy, if the left a girl.

Boys develop on the left, girls on the right side of the uterus.

Physiology is, of course, only a department of natural philosophy in general, without a knowledge of which no comprehension of physiology is possible. The same principles hold true in the universe as in the human body, which is only one manifestation of universal life.

The Chinese view the cosmos as having its origin in the interaction of two heterogeneous primitive forces (polarities), the male Yang and the female Yin ; its balance depends upon the harmonious activity of the two.

Yang (the active, positive principle, primitive warmth, light) is usually represented by the heavens ; Yin (the passive, negative principle, original moisture, darkness), by the earth. By means of the constant, opposing, gradually altering influence of the male (creative, progressive) upon the female (destructive, retrogressive) force, the great diversity of things takes place. Variation in sex, in character, in outstanding features and forms is, fundamentally, the result of the preponderance of Yang or Yin. The former is active in the sun, in light, in spring and summer, in youth, as strength, dryness etc., the latter in the moon, the shade, in autumn and winter, in old age, as weakness, cold, damp, softness etc.

Matter consists of five elements, viz. wood, fire, earth, metal and water ; every object is compounded of these, in varying proportions.

As in the act of creation wood (plants) sprang from water, fire (by friction) from wood, earth (ashes) from fire, and metal from earth, so in the course of nature the sequence of the transmutation of matter continues in the same direction. From this Chinese natural philosophy deduces the relation of the different elements one to the other : viz. descent, friendship, enmity. Thus fire has wood as its mother (as it arises from wood), earth as its son (ashes arise from wood), water as an enemy (as it puts out fire), metal as a friend (since metal exerts no influence upon fire). The same relations are given for each element, friendship being always opposed to enmity.

With the five elements stand in inter-relationship the five planets (Jupiter, Mars, Saturn, Venus, Mercury), the five atmospheric conditions (wind, heat, moisture, drought, cold), the five parts of the world (east, south, meridian, west, north), the seasons of the year (besides our own four seasons the last 18 days of spring, summer, autumn, and winter were distinguished as a separate season), the five times of day, the five colours (blue-green, red, yellow, white, black), the five tones etc.

As in the cosmos so in man the two primeval forces Yang and Yin are the fundamental conditions of all processes. The human body, like matter in general, consists of the five elements and these find in certain organs their chief representation : health depends upon the equipoise of the male and female principles, on the proper quantitative relationship between the elements. The male principle—vital warmth—rules, in accordance with its tendency to expansion, chiefly over the contractile hollow organs, the “chambers” (like the large and small intestines, bladder, gall-bladder, stomach) ; the female principle—elemental moisture—has its seat in the more solid viscera (liver, heart, lungs, spleen, kidneys) ; each of the principles possesses a reservoir and both together circulate with the blood and the vital air, which serve them as vehicles, in the vascular system and by them are led to the organs and then to all parts of the body ; disturbed circulation is the cause of disease.

The vascular system consists of twelve chief veins, of which six contain the positive, and six the negative element ; they partly begin, partly end in the hands and feet. The twelve veins are completed by two main collecting channels, of which one, coursing at the back of the body, contains the positive, and the other, running in the front of the body, the negative element. The twelve veins have twenty-three branches, besides which a number of small vessels are described.

It is an interesting fact that Chinese physiology supposes a circulation of the blood and vital air and asserts that in twenty-four hours fifty circuits occur. During a respiration blood and air travel six inches.

The five elements are represented in the human body by five chief organs (entrails), which are supported by five others (hollow organs "chambers") as assistants (brothers)—having therefore a cognate function. The liver corresponds in quality to wood, the heart to fire, the spleen to earth, the lungs to metal, the kidneys to water. The liver has as its assistant the gall-bladder and both serve to filter the juices ; the heart receives chyle and turns it into blood, its assistant the small intestine turns food into chyle ; spleen and stomach carry out digestion ; the lungs allow the blood to circulate and purify it from phlegm ; their assistant the large intestine has the task of voiding coarse and unclean matters ; the kidneys with the ureter take part in the secretion of urine which goes into the bladder. The right kidney, "the gate of life," has in particular assigned to it the rôle of the production of semen (seat of strength), whilst the liver is the seat of the soul, the bile of the spirit, and the lungs regulate the temperament.

In conformity with the constitution of the body from elements Chinese physiology connects each of the five organs with a cosmic or telluric manifestation (constellation, celestial region, time of year etc.) and similarly with one of the five tones or smells, colours or tastes. Each organ, in addition to its main function, exercises an influence upon a distant part of the body (*e.g.* a particular part of the face, a special tissue) and stands to other organs in a sympathetic or antipathetic relation. The most marked characteristic, however, of each individual organ consists in the possession of a variety of pulse peculiar to it. These highly strained analogies are in Chinese eyes of great practical significance since each pathological disturbance makes itself known by a departure from the system of inter-relationship which is considered normal.

In diagnosis and prognosis relatively little value attaches to the anamnesis, these being based chiefly upon a careful objective investigation of the whole body. All manner of sophisticated subtleties are dealt with, derived from the maze of the doctrine of "correspondence" ; here and there, however, a few genuine observations, the result of experience, are to

be found. The Chinese physician takes into consideration the physical temperament and general condition, the state of mind, the sensations of smell and taste, even the appetite and dreams of the patient. He notes the breathing and the sound utterances (voice, weeping, laughing, sighing, etc.), investigates the temperature (by palpation) and the nature of excreta (amount, colour and consistence of the nasal mucus, sputum, urine and faeces). He pays attention to the colour of certain veins and even the nature of the hair comes under his scrutiny. In these, the harmony or dissonance of the signs, as well as the influence of the atmosphere, time of year or day are considered, but they only constitute an amplification of the results of investigation obtained by the two most important diagnostic methods: by the examination of the pulse and inspection of the face and tongue.

Chinese pulse-lore is highly complicated and constitutes in practice a most detailed procedure, requiring in the simplest cases ten minutes, in more difficult ones several hours. Eleven positions are recognised, in which the pulse can be felt, each of which has its own name. Feeling the pulse is generally carried out upon the radial artery; the method consists in first laying the middle finger on the head of the radius and then adding the index and ring fingers whilst the thumb rests upon the dorsum of the carpus. The examination is made upon both sides, the physician using his right hand for the left pulse, his left hand for the right. The three places palpated on each side are viewed as three pulses and are given the names of "Inch," tsuen, "Narrow way," konan and "Shoe," tche; the first is felt under the ring finger, the second under the middle finger, and the third under the index-finger. There result, therefore, six pulses, each one in correlation with a definite organ, the normal or pathological condition of which it betrays. Thus the "Narrow way," konan, felt on the right side, corresponds with the stomach and spleen, felt on the left side with the liver and gall-bladder. Each pulse individually must be three times examined, first with weak, then with medium, lastly with firm pressure during nine respirations, attention being paid to their quality, rate and possible intermissions. The list of the pulse variations is an endless one.

According to Chinese sphygmology, each organ, in addition to its proper pulse, possesses an opposite one, varying with the seasons, and the pulses, even under normal conditions, alter according to the influence of the constellations, the time of year or day, according to age, constitution and sex, whilst under pathological conditions they react injuriously upon one another. The result of such a confusion of combinations is a prodigious list of varieties—illusory in our eyes—the knowledge of which demands a stupendous memory and an extraordinarily developed sense of touch. An example is furnished by the one fact that

not less than fifty-one chief types form the mere groundwork of the examination. Of these there are seven "external" pulses (corresponding to the positive elementary principle), eight "internal" (representing the negative principle), nine "way"-pulses (corresponding to the great channels of communication) and twenty-seven pulses which bespeak a fatal result.

Four to five beats to a respiration counts as a normal relationship, three beats point to an illness resulting from a preponderance of the male principle.

Touching the intermittent pulse, a single intermission after fifty beats is compatible with health; an intermission after forty, thirty, twenty, ten beats indicates that one, two, three, four internal organs are deprived of vital air and that death will follow within four, three, two, one years. The pulse lore is differently presented by different authors, important variations even occurring in the beliefs concerning the supposed relationship to the organs of the three wrist pulses on each side.

The pulse alone is considered sufficient foundation for a diagnosis of the nature and location of the disease. According to a favourite simile the human body resembles a stringed instrument whose individual parts possess their own tone colour (pulses of organs), and whose tones (pulses) are the expression of harmony (health) or discord (disease).

Inspection of the face and tongue rivals the pulse lore in importance, greatest attention being paid to the colour. Thirty-seven different appearances of the tongue are known.

Each organ is in correspondence with a particular colour which is decided by the prevailing element. In the human body the colours arise from the air which penetrates into the entrails. In pathological conditions the prevailing colour indicates the site of the disease. Prognosis depends upon the sympathy or antipathy of the pulse of the dominating organ with the dominating colour. In the former case the prognosis is favourable, in the latter it depends upon whether the colour corresponds with a friendly or inimical organ. The inspection of the colour takes place mostly upon those parts of the head and face which stand in relationship to the organ in question; thus the site for the heart is the tongue. Again if, in disease of the heart, the tongue, which should normally be red, is black (colour of the kidneys), it signifies that the kidneys, enemies of the heart, have acquired the mastery, whence the prognosis indicates destruction of the heart and a fatal issue.

Disease is a discord, a disturbance of equilibrium due to the predominance of the male or the female primitive principle (strength or weakness, heat or cold, dryness or moisture). It is evidenced by disturbance of circulation of the vital air or blood, whereby the organs suffer.

Chinese pathology looks upon wind, cold, dryness, moisture, affections and suffering, poisons, evil spirits and imaginary animals as causes of disease. Classification is carried out from various points of view (*e.g.* according to the pulse), the most rational division is that into internal and external affections or according to the body region or organ. Each individual type only corresponds to a symptom-complex and in the superficial description widely differing processes are thrown together. It causes no surprise, therefore, that Chinese pedantry should distinguish a large

number of sub-varieties, *e.g.* fourteen forms of dysentery. Excellent descriptions are frequently found, however, in the literature, particularly of infectious diseases.

The most elaborate branch of Chinese medicine, therapeutics, has at its disposal no small amount of material ; its medicaments surpass in number those of any other nation.

The conviction that in nature there exists a remedy for every ill, potent so long as it does not work counter to human fate, led to the trial of every imaginable substance of vegetable and animal and, to a less extent, mineral origin.

Even though empiricism, busy through centuries, has garnered a mass of useless things as well as some of real therapeutic value, many of these to be properly understood require further trial, and it may be assumed that such investigations would be to the advantage of medicine at large. The number of drugs in the use of which under similar conditions Chinese and European medicine are at one is not small.

To these belong rhubarb, pomegranate-root (for worms), camphor, aconite, cannabis, iron (for anæmia), arsenic (for malaria and skin diseases), quicksilver (for skin diseases), sulphur (for skin diseases), sulphates of soda and copper (emetic), alum, sal-ammoniac, musk.

Western medicine undoubtedly owes to the Chinese the use of rhubarb, which was introduced by way of the central Asian trade. With the exception of opium, Chinese pharmacy only imported the highly treasured asafœtida, nutmeg, cinnamon and pepper.

Of all drugs the one held in the highest esteem was the ginseng root which, on account of its tonic properties, was looked upon as a panacea and considered worth three times its weight in gold.

Especial popularity was enjoyed, as may be gathered from the formulæ, by pachyderma cocos, magnolia hypoleuca, extract of mint leaves, arum tubers, tang-kui root (for dysmenorrhœa), liquorice, bears' gall, burnt hair, realgar, cinnabar, etc. Cinnabar, which played the part in Chinese alchemy of the philosopher's stone, was used in the production of mercurial preparations and for fumigation in syphilis (a roll of paper filled with cinnabar was placed in one nostril, lighted and the mercurial fumes inhaled). As with us mercurial treatment of syphilis has been practised in China for centuries but it is more mildly carried out (inunctions with ointment of red oxide of mercury instead of grey ointment, internally calomel and sublimate mixed with calcium sulphate). It is also not the only method of treatment, (amongst other internal remedies are smilax and powdered pearl and mother-of-pearl). A number of materials are credited with warming, cooling, alterative or hæmatinic properties, purgatives, emetics

and expectorants are numerous and next to them in importance are diaphoretics and diuretics. In addition Chinese medicine possesses many emmenagogues, galactagogues, abortifacients and aphrodisiacs, which last are the chief constituents of the extraordinarily widespread and openly vaunted secret remedies.

One of the most remarkable peculiarities of Chinese medical art lies in its richness in substances of animal origin. Mysticism, albeit a dim groping after those ideas which in later days have led to organo-therapy, constitutes most probably the guiding motive when, for instance, preparations of liver, lungs and kidneys of different animals are prescribed for liver, lung and kidney diseases respectively, or when the semen of young men or nerve tissues of animals are given for conditions of weakness, hens' gizzards for diseases of the stomach, animals' testicles for impotence, placenta to assist childbirth. In conjunction with substances of such nature are found—as in the pharmacopeia of other nations and in European medicine of past centuries—utterly repulsive substances (excreta).

Prophylactic inoculation for small-pox, probably derived from India, is to be included with animal therapeutics. It has been practised in China at least since the eleventh century, having been, according to tradition, discovered by a philosopher, and may be looked upon as the precursor of serum-therapy. For this purpose a cotton wool pad saturated with the contents of a fresh small-pox pustule is placed in the nostril of the subject to be inoculated, (with boys in the left, with girls in the right nostril). Or else a powder from a dried pustule is rubbed or blown into the nostrils. On certain speculative grounds inoculation was not undertaken on the 11th or 15th of the month.

The classification of medicaments to which are ascribed specific relations with certain organs and diseases is most subtly elaborated in accordance with Chinese natural philosophy, a particularly important part being played by speculations on the analogies existing between constitution, colour, taste and specific action of the remedies.

Thus green materials and sour tasting drugs are supposed chiefly to influence the liver on account of the wood which is their chief constituent; on the same principle red and bitter materials influence the heart; yellow and sweet ones the spleen; white and sharp the lungs; black and salt the kidneys.

All warming or cooling materials with a strong action possess more the characteristics of the male primitive principle Yang, and the slightly tasting, or with pronounced sour, bitter, sweet, spiced or salt flavour, those of Yin. The ailments of the upper half of the body where Yang predominates, correspond to remedies derived from the upper parts of plants; the diseases of the lower half to those derived from the roots, where Yin is supposed to predominate. Finally the curative agents were brought into relationship with the seasons of the year, *e.g.* those working upwards resemble the growing powers of spring, the heavier,

more watery, downward-tending agents the failing powers of autumn etc. In prescribing, following an empiricism centuries old, attention is paid to the time of year, the weather and the sex of the patient; sometimes in the choice of drugs symbolism is the determining factor. Thus the red blossoms of the hibiscus are employed as an emmenagogue, saffron, on account of its yellow colour, in jaundice, beans for their shape in kidney trouble, glow-worms as an ingredient of collyria etc.

The number of mixtures prescribed for patients is very large; the preparations are often of pleasing exterior and attractive, the names they bear (*e.g.* the powder of the three most learned men, powder of five-fold origin) are calculated to influence the imagination and to add to their glamour.

Many physicians prepare their remedies themselves, but usually the prescriptions (written upon red paper) are taken to the apothecaries' shops, luxuriously furnished and respectably conducted establishments. The prescription is, as a rule, compounded of a number of drugs (seldom less than nine or ten), the ingredients are arranged according to their actions into ruler, minister and subordinates—corresponding to our basis, adjuvant and corrective. In the composition of prescriptions as in the ordering of doses the superstition of numbers comes into play; thus the number of substances ordered is frequently a multiple of five and five doses are generally given.

For every individual affection there exist a number of remedies, the choice of which, however, is subject to stringent rules, based on the pathogenetic indications—*e.g.* in bronchial catarrh according to the necessity for a stimulating, sedative or expectorant effect the following remedies are employed: celery, ginger, aconite, gentian, cinnamon, opium, thuja, bamboo, colt's foot, violets, burnt tortoiseshell, clay pills etc. Amongst the remedies for chronic bronchitis pig's lung is notable, amongst those for pneumonia liquorice mixed with sal ammoniac. Phthisis is treated with lung substance or with orange-peel prepared in an elaborate manner, or gelatine made from asses' skin cooked in arrack may be used. Heart affections are considered to be benefited, according to their supposed origin, by anaphrodisiacs, small doses of red lead, infusion of clematis, the root of chelidonium majus and powdered antelope's horns. The cure of oedema is attempted by preparations of smilax, convolvulus, black beans etc.; hæmorrhages by gentian, aconite, ginger, gypsum, borax, burnt hair, garlic, powdered rhinoceros horn, and "dragon's bones"—fossil bones? Uterine hæmorrhage is treated by irrigation with decoction of stinging nettles. In congestion of the liver Chinese therapy recommends, in addition to basil, bamboo buds and elephants' hide, particularly an extract of pigs' liver, ox-gall or bears' gall with arrack; for renal diseases, also pigs' kidneys.

There is a long list of remedies for stomach troubles: as stomachics are held in esteem pepper, cloves, green orange-peel, coriander, magnolia hypoleuca, chickens' crops, etc.; as an emetic betonia; as purgatives, plums, tamarinds, sulphate of soda, rhubarb, pigs' gall, croton etc., as styptics gentian or brown ochre—the sovereign remedy however remains ginseng root.

Besides the simple remedies there are many mixtures in use and the dietetic régime is by no means neglected.

For dysentery numerous remedies are recommended, bat-droppings, snakes' skin etc. in addition to rational ones, aloes, rhubarb, pomegranate root, cinnamon, musk, ginseng etc.

Obesity, not uncommon in China, is not treated. Nervous affections are richly supplied with remedies of which only a few can be enumerated. A favourite remedy for migraine is oil of peppermint, for headache, amongst many other substances, the brain and marrow of the stag, for weakness induced by sexual excess, powdered stag-horn and numerous aphrodisiacs. Epilepsy is treated with silkworms and rhamnus root; lameness, of which there are many forms, with maple root, strychnia, cinnabar, tigers' bones, musk, etc.; convulsions with a kind of valerian. The most commonly used drugs for articular rheumatism are reeds, smilax, aristolochia, calcium carbonate; for malaria, magnolia, cooked tortoise-heads, buffalo cheese, peroxide of iron, potentilla.

The treatment of small-pox includes a number of substances and is governed by strict rule; cholera is treated by the above-mentioned intestinal remedies; diphtheria by revulsion (*i.e.* the artificial production of ecchymoses in the neck) and the insufflation of astringent remedies; plague by purgation, diuresis and diaphoresis. The therapeutics of the skin—itch is ascribed to a parasite—include many remedies for external application, *e.g.* sulphur, alum, arsenic, quicksilver, but internal medication was not forgotten. As regards gynaecology the Chinese (like all Eastern) physicians distinguish a whole series of menstrual disorders, looking upon them as independent affections, according to the abnormal onset, duration or colour of the menstrual fluid, or according to aetiological considerations. Treatment of children's diseases receives much attention, at least fifty-seven varieties being known—naturally on the lines of the speculative system. The dosage is regulated by the following rules: a substance, the adult dose of which is 12–20 grammes, is given up to the seventh year in doses of 4–6 gr.; from the eighth to thirteenth years, 6–8 gr., and in the thirteenth to eighteenth years in doses of 8–12 gr.

In children's diseases the most important diagnostic sign is, curiously, the changing colour of a vein on the index finger (in boys on the left, in girls on the right side).

Rivalling medicinal treatment and employed under every conceivable condition are the methods of moxibustion and acupuncture. The moxa consists of little rolls or cones, kneaded most frequently from the woolly, tinder-like leaves of artemisia, also from sulphur or rush pith soaked in oil; they are stuck on with saliva or placed by means of a metal plate on the body surface and lighted. Minute directions exist governing the choice of locality for their application, their number and arrangement (as many as fifty in strong people), their function being to make a passage for the stagnant pathogenic materials or to draw them out. In diseases of the breast they are applied to the back, in diseases of the stomach to the shoulders, in venereal diseases to the spine. Moxibustion, it may be mentioned, also serves as a prophylactic. Acupuncture, which appears to have been a Chinese discovery, consists in thrusting more or less deeply through the stretched skin, (whilst the patient coughs) fine needles (5–22 cm. long) made of hardened steel, silver or gold (or the needle may be driven in by a blow with a hammer on the spirally fluted head) and pushed further in with a screwing movement. After withdrawal of the needle pressure is exercised upon the seat of puncture or a moxa is applied to it. The

number of needles used, the direction of their rotation (to right or left), the depth to which they are inserted (generally $3-3\frac{1}{2}$ cm.), the length of time they are left in, all depend upon the nature and severity of the individual case, or upon the conception of these which accorded with Chinese theories of disease. In connection with this is the fact that inordinate care is taken in the choice of spot for puncture, avoidance of injury (as to the nerves) being kept in mind. The body has 388 named spots where acupuncture is performed, the exact knowledge of those is presumed on the part of the Chinese physician and the operation is practised on perforated dummies pasted over with paper. At the root of the acupuncture lies the idea that the body is permeated by a system of tubes and that this procedure allows harmful materials an exit, removing obstructions to the circulation of the juices, whilst fresh vital spirits are introduced. Although chiefly undertaken in painful or inflammatory conditions, the method plays an important part in the most varied affections (particularly abdominal ailments, stone and even fractures).

Their predilection for moxibustion and acupuncture explains the fact that the blood-shy Chinese physicians seldom make use of venesection; cupping, dry and with copper cupping vessels, on the other hand, is amongst the usually practised derivative procedures, and comes into play in several diseases. Massage is carried out with great skill, mostly by the blind or by old women, and medical gymnastics, known for centuries in China and supposedly the discovery of the mythical Tshi-sung-tin about 2500 B.C., constitutes a complete system. This consists of rhythmical systematic in- and expiration in definite positions of the body, friction of the abdomen, beating the breast and back (by means of a bag filled with pebbles), accurately planned muscular movements, resistance exercises etc. The complete cure extends over months, associated with a dietetic régime, and is intended to regulate the circulation of the vital air and juices.

Finally baths must be mentioned, which are much prized as means of preservation of health, and suggestive therapeutics which appear hidden in the protean manifestations of theurgy.

Surgery, owing to the lack of anatomical knowledge, and to the national hæmophobia, has never risen above the most primitive level; obstetrics remains almost exclusively the province of the midwife.

The surgical armamentarium of the Chinese physicians consists of rough, badly finished implements, more fitted for a cobbler than a surgeon. The treatment of fractures, corresponding to the anatomical knowledge, is very inefficient; difficult displacements remain uncorrected, the chief method of treatment consists in an adhesive plaster and immobilisation

by bamboo splints and bandages; compound fractures, after attempted reposition, are treated by dusting the wounds with a healing powder and covering them with a freshly killed chicken whose bones have previously been removed.

Hæmorrhage is arrested by styptics and bandaging. Superficial abscesses are treated by incision, but only after much time has been lost with the purpose of allowing ripening to occur (by application of dried toads, litharge etc.). Owing to the prevailing view that in all injuries the liver is in an unhealthy condition, an internal remedy is usually employed as well as an external (*e.g.* in fractures internal use of boys' urine). Ulcers are treated by salves, the actual cautery being employed for chronic ulcers. It is remarkable that the Chinese are on the one hand less subject to accidents than Europeans, on account of the paucity of large industrial concerns, and on the other show a greater tolerance to injuries and operations, as is particularly shown in compound fractures.

There are two different methods described in which castration is performed. According to one, the genitals are made insensitive by kneading in a hot bath or in certain media. The penis and scrotum are then bound up tightly in a roll and amputated close to the pubic arch with a single stroke, whilst upon the wound is pressed a handful of a styptic powder.

The bleeding being arrested by compression and a nail-shaped plug being inserted into the urethra, the operator applies a bandage which is left on for three days, during which time the patient is not allowed to drink anything.

Another description is that of the bloodless method, which consists in the production of gangrene of the insensitised genital organs through gradually applied torsion and ligature (by means of silk threads). Separation occurs in fifteen to twenty days, healing in two months. Artificial distortion of the feet of Chinese women is brought about by the application, from about the seventh year, of very tightly applied bandages which strongly flex the four outer toes and bring the heel into a vertical position.

Dentistry is very backward; irritating plasters, moxa and acupuncture constitute the chief remedies, at the utmost loose teeth are extracted with levering instruments.

In ophthalmology a few operative methods are employed (*e.g.* paracentesis of the anterior chamber) and also a few most unusual methods of cure. Treatment of errors of refraction with corrective glasses has been practised for centuries.

General anæsthesia is known to the Chinese, and is produced by administration of narcotic extracts, such as aconite. The artificial induction of painlessness by narcotic draughts was traditionally known in ancient times and it is related of the physician Hoatho in the third century A.D. that he performed amputation, trephining and other major operations by its aid—though this is not very credible.

The lack of anatomical and physiological knowledge is distinctly seen in the department of obstetrics, in which indeed a familiarity with many practical measures and manœuvres is shown, but it is for the most part grounded upon preconceived and erroneous ideas.

The active aid of the physician is only rarely called for and only extends to the prescription of internal remedies (for cramp, pain and even for alteration of the presentation). Aid to parturition is thought to be rendered by certain medicinal potions, in the composition of which, in addition to rational ingredients, (*e.g.* ergot) most remarkable substances, such as bat-droppings with children's urine, enter.

Interference in difficult labours is left to the midwives, such as procedures for correction of faulty presentations, reposition of a prolapsed arm, extraction, removal of a dead child by means of a double iron hook following embryotomy.

In pregnancy a particular diet is recommended (cool and fatty articles); parturient women are advised to walk round the room from time to time so that turning of the child may occur, since, according to Chinese views, it is only at the last that the head assumes a dependent position. With the commencement of the stronger, more forcing pains the woman is held in a half doubled-up position and a wooden basin placed beneath her to catch

the child. The lying-in woman must spend at least three days propped up in bed, her nourishment consists of millet and rice-water, for fourteen days she must not wash or comb herself; internally to expel the unhealthy blood is administered a cup of the urine of a three to four year old child; dried placenta serves to combat the anæmia. On the fourth day a moxa is placed upon the umbilical cord of the new-born child or else it is cauterised with horse-radish; nursing continues till the third year; in addition to these and other measures the care of the lying-in woman and the newly-born child is surrounded by a mass of instructions originating in the traditional sacred mysticism of the midwives. In spite of legal prohibition artificial induction of abortion is very common and is attempted in many different ways (application of leeches to the cervix uteri). Special works treat of presentations and the diseases of nurslings.

Although the earliest Chinese literature contains in part most reasonable rules of life, *e.g.* concerning the proper apportioning of work and rest, suitable regulation of food, drink and clothing, according to season etc., yet public hygiene is an unknown quantity. The disorder in the streets of the chief towns amply illustrates this lack of supervision.

In the works of Tschang-Seng (=long life, translated into French by the Jesuit father d'Embrecolles) it is recommended amongst other things to rise early, to breakfast before leaving the house, to drink a little tea before eating, to eat at the midday meal food well cooked and not too salt, to eat slowly and afterwards to rest two hours asleep, to take little at night, before going to bed to wash out the mouth with tea-infusion and to warm the soles of the feet by rubbing them.

Chinese forensic medicine is of great antiquity and is regulated by an official codex which dates from the year 1248 A.D., from a time therefore when Europe boasted of no analogous work.

The title of this is Si-yuen-luh, *i.e.* "collection of the means by which a wrong is avenged." The work distinguishes itself by the precision of its statements but is, on the other hand, calculated, through the binding character of its dogmatically enunciated theses, to lead to miscarriage of justice and to prevent legal execution. It is divided into five books, the first of which deals with murderous assaults, inquests, criminal abortions and child-murder; the second with suicide, death by hanging, drowning and burning, whilst the third and fourth describe the signs of poisoning, and the last book contains a general description of judicial examinations.

As with everything else in China, forensic medicine is distinguished by a pedantic character, attaching undue importance to accessory details and dazzling by a display of learning whereby really searching investigation is subordinated to scholastic pretence.

Accurate and practical thought is intermingled with fantastic speculation—most dangerous upon such a subject. Inquests are obligatory in cases of death from uncertain causes, the coroner's regulations are painfully meticulous, but there are no post-mortem examinations and the most important findings are sustained upon external inspection or upon such inquiries as are often equivocal or even fantastic.

The following are a few examples. Wounds not plainly visible on the body become so by pouring vinegar upon it, or by inspection in sunlight allowed to fall through a piece of silk saturated with oil. Traces of blood removed from a knife come into sight again if it be heated to red heat and have vinegar poured over it. The relationship of two people is proved if a specimen of the blood of each runs together in water; to recognise the skeletons of their parents the children allow their blood to drop upon them, if it soaks into the bone the fact is proof of the relationship. A blow upon the cord by which a man is hanging indicates by the manner of its vibration either suicide or murder. To prove that poisoning has occurred a silver needle (previously passed through an infusion of *mimosa saponaria*) is placed in the mouth of the corpse, which is stopped up with paper; if the needle becomes blue-black and remains so after washing, the poisoning is proved. The same holds good if a hen dies after having been fed on rice kept for twenty-four hours in the mouth of the corpse. Signs that a body found in the water was alive on entering it are held to be: a much distended abdomen, hair pasted down on the head, foam in front of the mouth, stiff hands and feet, white soles, sand under the nails.

The assumed stability of Chinese medicine doubtless rests on the fact that we are insufficiently acquainted with the phases of its evolution. The crystallisation of medical theories into an unalterable form could only have occurred after long development, the final results of which are certainly referred by popular tradition to a far distant period. Here and there, however, the literature which has come to light betrays (*e.g.* in the matter of pathogenesis, classification of disease or pulse-lore) the existence of divergent opinions and demonstrates the remains of discarded doctrines. The present condition is certainly one of decadence, as is admitted by Chinese authors themselves.

The downfall finds its most decided expression in the lamentable condition of instruction, which is at most the shadow of a once flourishing organisation. Whilst under the Tang dynasty (618-907 A.D.) schools flourished throughout the empire, largely frequented and taught in by original investigators, there exists now only an imperial medical institute in Peking, whose function it is to train, by theoretical instruction, official, court and body-physicians. Medicine is a free profession, with no compulsory examination, and any one, often from philanthropy or predilection merely, may practise it. The government concerns itself not at all with instruction or proof of capacity; the progress of science, however, is checked by the medical court institute (which, as custodian of the ancient technical classics, has as its care the preservation of the teachings of scholastic medicine) and by the punishment which threatens the least deviation from the canon. With the exception of the members of the medical court institute, who rank as mandarins (7th to 4th class) the physicians are of the people, and rank above the little-esteemed priesthood, but below the diviners and school teachers. The regular education demands that the candidate should first acquire adequate knowledge from the medical classics; he then learns from an experienced practitioner the methods of examination and treatment of the patient; two years at least are required for this. Most confidence is placed in those who spring from medical families, and who have received parental instruction and in those who can point to the greatest number of professional ancestors. In addition to these descendants of medical families there is a crowd of literati who, finding no maintenance in the state service, are compelled to find another outlet, without counting the self-constituted teachers and quacks of every kind. Specialism is very fully developed in China.

Only the Manchus have regular family physicians. In general the honoraria are very small, whilst the physician does not usually visit the patient continuously but only upon repeated invitation, a custom which naturally makes any real observations upon the processes of disease and actions of drugs impossible. With the exception of the introductory ceremonies of etiquette the most important part of the visit, which usually takes place in the morning, consists in the examination of the pulse, whilst the anamnesis receives much less attention.

Upon the subject of medical ethics a work published in the time of the Ming dynasty says that the physician should lay the following to heart: "When a patient is severely ill, treat him as thou wouldst wish to be treated thyself. If thou art called to a consultation go at once and do not delay. If he ask thee for medicine give it him at once and do not ask if he be rich or poor. Use thy heart always to save life and to please all, so will thine own happiness be exalted. In the midst of the darkness of the world be sure there is some one who is protecting thee. When thou art called to an acute illness and thinkest with all thy might of nothing but making money out of the patient, if thy heart be not filled with love of thy neighbour be sure that in the darkness of the world there is some one who will punish thee."

The influence of Chinese medicine extends beyond the borders of the Middle Kingdom. It is felt, for instance, in the medical lore of the Annamese and Siamese, whose knowledge does not in general attain the height of that of their teachers.

In the north, Korea, whence was derived the best kind of ginseng root, constituted a colony for Chinese medicine, also an intermediate stage on its path to Japan.

Previous to the introduction of European culture into the land of the Mikado China was to Japan what Greece once was to Rome, the source of all morals and culture. For a long time the "land of the rising sun" received the germs of Chinese science and religion, art and technology, only indirectly by way of Korea, which stood in closest relation with it. Only a change in political conditions made direct intercourse possible between the two most important countries of the far East.

This intercourse gave also to Chinese medicine a new home in Japan, where in the ninth century it completely ousted the native art and maintained its supremacy, though not without further development, until the last third of the past century.

The system which European medicine has in recent times replaced in Japan is mainly that of China. Before, and in part with, this there existed a primitive, autochthonous, ancient Japanese medical art, founded upon primitive observation, and free from speculation, which differentiated a considerable number of diseases and had at its command an abundant therapeutic store, consisting mostly of indigenous medicinal plants.

The ancient Japanese physicians knew four varieties of pulse, established their diagnosis upon a basis of observation, interrogation and manipulation, were masters of simple surgical procedures, and ordered bitter astringent substances in diarrhoea, diuretics in urinary disorders, cold baths for fever, and diaphoretics for chills.

The invasion of Chinese medicine began in the third century A.D.; from this time onwards

was developed a very brisk intercourse with Korea, the most important fruit of which was the introduction of Chinese civilisation, and hence Chinese medical methods, into Japan.

Although at first foreign practitioners were only summoned to the court, under its protection Korean physicians came yet more frequently and in greater numbers into the country to act as instructors and to make youthful talent familiar with Chinese science, an aim which the presence of Chinese Buddhists did much to further.

At the end of the seventh century schools of medicine were founded in the capital and in the provinces under Korean guidance and with State support: whilst energetic young men were sent to China to study on the spot. Chinese medicine hereby received in Japan the stamp of official recognition, whereas native medicine increasingly lost ground, holding its own awhile in remote villages and in the darkness of the Shinto temples before finally sinking to the level of folk-medicine.

There are not wanting evidences of occasional national reactionary movements, one of which found expression at the beginning of the ninth century in an imperial order commanding the formation of a collection of ancient Japanese prescriptions and recipes. But this came too late; the work, collected with great labour, remained nothing but a literary monument without real influence and soon fell into oblivion. From the ninth century onwards Chinese science became completely naturalised; a flourishing system of education—in which women had part—ensured its continuance, and the newly erected hospitals and institutions where medicines were dispensed to the poor made for its popularity among the people. During the terrible civil wars which convulsed the land in the twelfth to sixteenth centuries medicine declined greatly, without, however, completely lacking worthy representatives.

At the commencement of the sixteenth century it awoke from its lethargy and although the guiding influence of the Chinese teachers long remained, yet a few medical thinkers had the temerity critically to attack the current doctrines and to secure recognition for their individual experience while reviving many forgotten methods of ancient Japanese medicine.

In earlier days the medical profession was recruited almost solely from the highest ranks of society, those belonging to the lower classes were only old people.

The feudal system, introduced at the beginning of the seventeenth century and only coming to an end in 1868, distinguished between princely and popular physicians. The former, a strict hierarchy (physicians to the Mikado, the Shogun, and the Daimio), came from the noble caste and were recruited from those members of it who were unfitted for war service; the latter belonged to the common people. Both possessed the same long-sleeved robes of office, the princely physicians, however, carried the distinguishing sword; later a dress-sword was worn.

Whilst the princely physicians had a definite precedence, each according to his rank, and were designated by a variety of titles, the popular physicians were at the mercy of the charity of their patients, to whom was left by law the determination of the fee. "When the disciples of medicine," so it is written, "cure illnesses with skill and are successful, they must not be accorded too great an income lest they neglect their duty." The average fee was two to four times the amount allowed the physician as the value of his home-made medicaments. To obtain his rights the oppressed and defenceless physician had only one weapon at his disposal—flattery. The disciples of healing had opportunities of learning the use of this when accompanying their masters upon their visits, as was the custom.

Little gifted in the foundation of a culture of their own, but exceptionally apt in the assimilation of the elements of foreign civilisation, the Japanese rapidly acquired the most important features of Chinese medicine from the standard works and produced a copious scientific literature, faithfully reproducing their models.

In matters of theory the Japanese intellectual peculiarities found little scope, outside discussions upon textual criticism and explanatory additions, for the fetters of the Chinese system make further speculative development impossible. In practice, however, which, with their leaning towards realism, offered the greatest attraction to the Japanese physicians, there are here and there evidences of a local colouring whereto the dim traditions of the medical art form a background. Such are, for instance, the frequent use of diaphoretic means for catarrhs and of hot baths, the latter a custom influenced by the hot springs of the country.

Moxibustion and acupuncture were also in Japan the favourite methods of treatment, together with massage which is carried out with great dexterity and according to certain theoretical principles. There are specialists for acupuncture; moxa are applied, not by doctors, but by low-caste people, particularly old women; massage is most practised by blind rubbers.

The pharmacopeia was moulded upon that of China; surgery remained upon a low level before the introduction of European methods. The tooth-extraction of the Japanese is peculiar to them (the tooth being first loosened with a piece of wood and a hammer and then extracted with the fingers).

From the sixteenth century onwards began a gradual striving towards emancipation, followed on the part of good individual observers and in some branches of medicine by a certain independence of Chinese dogmatism. Representatives of the new movement were Manase Shokei, and his pupil Tamba (who looked upon heat and moisture as the most important causes of disease, commenced cures with diaphoretics and laid great stress upon examination of urine and fæces)—but most particularly the great Nagata Tokuhon. This most capable observer—who deserves the honourable title of the Japanese Hippocrates—looked upon Nature as the greatest healer and simplified the complicated therapy then existing, starting from the idea that the essential requisite is to assist the healing power of nature. This enlightened conception naturally brought him into conflict with Chinese formalism; he made bold, for instance, to allow fever patients to drink cold water.

Profound knowledge of human nature is betrayed in the fact that Nagata Tokuhon, instead of worrying neurotics with drugs sought to cure them by psychological influences, after having established the cause of the trouble.

Thus he spoke to the farmer of quickening rain, to the maiden of her coming marriage, to the wife of the speedy return of her absent husband.

Obstetric medicine received in the eighteenth century a development independent of China, principally owing to the fact that, removed from ordinary practice, it rested in the hands of specialists, who in part built

upon a foundation formed by the rational methods of ancient Japanese medicine.

Even in ancient Japan the treatment of pregnant women received great attention. There was a special birth-chamber in which the woman dwelt three weeks before and three weeks after delivery. In the second half of pregnancy a belt was worn and by rubbing the abdomen the production of a correct presentation was attempted. During the birth and for eight days afterwards a special birth-stool was employed. After the middle of the eighteenth century obstetrics received a great impulse through Kagawa Shigen, at one time a rubber and acupuncturer. He published in 1765 an epoch-making work, *San-ron*, in which he attacked many erroneous Chinese views and collated many sound observations intermingled with *a priori* conclusions. The successors of Kagawa Shigen worthily continued these rational endeavours. The following particulars may be mentioned as having been known and practised: the knee-elbow parturient attitude; care of perinæum; double ligature of umbilical cord and section of the same with scissors; powdered gall as a styptic; removal of the retained placenta by rubbing the abdomen and pulling on the cord; eventual instrumental extraction; nursing only after the fourth day.

Operations: extraction in foot presentation, combined internal and external cephalic and podalic version, perforation and decapitation; since the beginning of the nineteenth century Japanese accoucheurs have made use of the whalebone fillet. Whether the obstetric instrumentarium is of European origin or independent of it is still uncertain.

Thus prepared, Japan was a favourable soil for European medicine and although on account of extraordinary obstacles it did not fully establish itself until the last three decades of the nineteenth century, the traces of its gradual advance can be much earlier made out. This began with the missionary activity of the Portuguese and reached its highest point in 1871 with the foundation, on a German pattern, of the medico-chirurgical academy in Tokio.

To-day Japanese medicine has relinquished its position of isolation and is a worthy associate in the confederation of world-medicine.

APPENDIX

THE medicine of the ancient civilisations of America shows many similarities to that of the East, a similarity which extends not to individual methods alone, but to the guiding principles. Relatively the best known up to the present is the medicine of the Aztecs, which at the time of the conquest of Mexico could boast a long evolution. The ancient Mexican art of medicine lay at that time in the hands of an independent order of practitioners, who were divided into physicians in the narrower sense and surgeons, of whom the phlebotomists constituted a lower class; obstetrics was in the hands of midwives, who were held in particular esteem; the collection of simples was undertaken by herbalists who exposed their wares for sale in the market-place. When empirical knowledge was found wanting witch-doctors stepped in, who were past masters in the technique of suggestive treatment. It is a noteworthy fact that the ancient Mexicans possessed hospitals (particularly for wounded soldiers), and institutions for the incurable.

The first theoretical instruction was imparted in the priestly colleges, the priests being the custodians of culture and science; practical teaching, which was mostly imparted by father to son, dealt with doctrines of disease, preparation of drugs, and clinical methods. The Mexicans, amongst whom the descriptive sciences attained a high development, possessed botanic gardens distinguished by the inclusion of large numbers of medicinal plants; these served physicians for the purposes of study, the zealotness of which is indicated by the fact that they even produced coloured plant atlases. Doubtless impelled rather by motives of curiosity than scientific enthusiasm Montezuma maintained in his palace a living pathological collection composed of the deformed, cripples, dwarfs, etc. We have as yet no facts indicating the extent of ancient Mexican knowledge of anatomy.

The mythology of the ancient Mexicans had a strong medical colouring, medicine was traced to a divine source, there existed a special goddess of medicine, personifications of diseases or remedies, and deities which inflicted certain diseases upon mankind or cured the same. A custom peculiar to the Aztecs was the ritual blood-letting from ears, eyelids, nose, lips and arms. This was a substitute for human sacrifice, although it was carried out *in toto* as a preventive against pestilence. The conviction that diseases were punishment and inflicted by the gods or due to the malign influence of sorcerers was naturally a great support to theurgy or medical magic, whilst, as with Oriental nations, obstetrics and pediatrics were in particular permeated with every kind of mystical usage. On the other hand a hint of rationalism is shown in the doctrine that certain illnesses are produced by cold or moisture, harmful effect of wind, potus, drinking water that has stood overnight, excessive coitus, or infection.

In order to determine whether a disease were curable or not the patient was given a sternutative powder; if sneezing occurred the sign was held to be of good omen. The physician arrived at his diagnosis by observation of the symptoms of the complaint and possessed a knowledge of drugs attained through experience, but the main factors indicating prognosis and the therapeutic measures to be undertaken were astrological, the calendar being the highest oracle of the ancient Mexicans. As in the case of the ancient civilised nations con-

stellations, particular days, parts of the body and remedies were brought into relationship by means of the doctrine of correspondence ; the signs of the days, corresponding with our signs of the Zodiac, ruled the individual parts of the body ; the course of a disease was estimated from the date of its commencement ; the choice of remedy was determined by the sign of the day, no remedial measure being permissible on the last five days of the year. Medical magic also prognosticated the fate of the patient by the flight of birds, sounds emitted by animals, or by certain mystic procedures, such as casting lots with maize grains, knotting threads and undoing knots ; to this category also belong exorcism of disease and mystical translation of feverish or contagious ailments to others.

A method of arriving at a diagnosis in serious cases consisted in causing the patient, by means of certain drugs, to pass into a somnambulistic trance, in the expectation that the medium would then himself indicate the disease and its site.

The Aztecs differentiated a considerable number of symptom-complexes as independent affections, amongst which were various urinary and venereal disorders—they were probably familiar, not only with gonorrhœa and chancre, but also with syphilis—and diseases of the skin. The chief therapeutic measures, in addition to a well-stored pharmacopeia, were venesection, scarification, baths and diet. The number of different plants used is comparable only with that employed in Chinese or Indian medicine and formed the chief source from which drugs were prepared. Mineral substances occupied a subordinate position, whilst amongst animal substances were such things as portions of vipers, of chameleons, lizards, flesh of jaguars etc. Amongst external applications the ancient Mexicans employed suppositories, the clysmas, injections (urethral), inhalations, snuffs and perfumes. The pharmacopeia included emetics, purgatives, diaphoretics, narcotics, sedatives, aphrodisiacs, diuretics and hæmostatics. Derivatives were also applied at a distance from the painful spot.

There was an extensive knowledge of poisons and antidotes, one of the favourite of these being *Dorstenia Contrayerba* which, following the identification of poison as disease-agent, was also used as an antitoxic prophylactic in epidemics (the same drug was also long in use in Europe under similar conditions). The isopathic principle found expression in an universal antidote which consisted in a mixture of all kinds of animal poisons.

Spanish contemporaries, even the great conqueror Cortez, are loud in their praises of the surgical dexterity of the Mexican physicians. Apart from treatment of wounds, ulcers and burns, for which they possessed many topical applications, the Aztecs undertook venesection, scarifications (with the spines of the agave) and were familiar with suture (with clean hair). Lacking iron, they fashioned their instruments from obsidian. Abscesses were opened by crucial incision, œdematous swellings were scarified. The greatest care, however, was lavished upon the treatment of fractures. The parts having been brought into apposition, the Aztec surgeons applied immobilising dressings which were usually left in place for twenty days ; these dressings consisted in the first place in a sticky, very tenacious plaster, which was covered outside with feathers ; next came four parallel splints which were fastened with straps.

The care of children, as well as obstetrics, which was in the hands of midwives, was permeated with religious and superstitious methods which, however, hid many hygienic medical ideas. The mode of life of the pregnant woman, amongst the well-to-do at any rate, was carefully regulated as regards her nourishment, occupation and sexual functions ; upon the onset of labour the fœtal position was repeatedly examined, correction by external manipulations attempted, medicaments given which strengthened labour, lessened pain and were supposed to guard against fœtal fractures. After normal birth the umbilical cord was severed, the infant put, with religious ceremony, into a bath and scarified upon the genitals, scarification having in general with the Aztecs a religious hygienic significance, whilst the mother was submitted to a strict régime with repeated vaginal injections, fumigations and baths : the child was only completely weaned at the end of two years. In cases

where birth did not proceed naturally a favourable outcome was sought by means of prayer, suggestion, emmenagogues, external version and shaking. If these measures did not avail, after protracted endeavour and signs of death of the fœtus, embryotomy was undertaken by the midwife in the most primitive manner with a stone knife.

Performance of the operation was, however, only subject to the permission of the parents, and if this were withheld, the unfortunate woman could only be left to die. Popular belief placed death in childbed upon the same level as death upon the field of battle and the dead were accorded divine honour also, since it was feared that the ghost would haunt the new-born child and harm it.

Hygiene stood upon a comparatively high plane and dealt with both public and private life; in theory at any rate, strict laws were enacted against sexual excess and drunkenness.

The astonishing development of Aztec medicine is the more striking since, in spite of many analogies with that of the East, no connection between the two has so far been established.

We have far less information concerning the medicine of the other civilised or half-civilised races of ancient America, although it appears that the attainments of the Aztecs were never surpassed. The Quiché in Guatemala possessed notable experience in dentistry, ophthalmology, psychology and hydro-therapy. Other races of Central and South America were so far familiar with the diagnosis of skin diseases as to distinguish numerous varieties of dermatoses and to attach names to them.

The ancient Peruvians also distinguished themselves in the same subject, their realistic representation upon clay vessels awakening the liveliest interest. It is a remarkable phenomenon that Peruvian sculptors in representing the human form invariably chose hideous pathological objects, which is explained by the fact that everything abnormal, atypical, and strange appeared the more worthy of worship the uglier it was.

Amongst the Incas of Peru there prevailed the custom of distorting the heads of infants into certain prescribed forms, of which four existed: the round head, the broad head, the narrow, long skull and the pointed. This custom is said to have arisen in order that children, by limitation of their intellects, should remain obedient. Medicine amongst the Incas appears to have been far less highly developed than among the Aztecs. There were medical deities in their mythology (the moon-god was appealed to by women requiring aid in labour) and the priest-physicians wrought cures partly by incantations, massage and blood-letting, partly by vegetable substances in decoctions and infusions.

MEDICINE IN CLASSIC ANTIQUITY

INTRODUCTION

A COMPARATIVE survey of Oriental medicine, even though extending over thousands of years, presents a uniform picture, only relieved by varying national colour.

The isolated facts of an accumulation of specialised knowledge and applied methods full of promise for the future are forced, by a highly organised learned caste, mostly of the priesthood, into wide-embracing synthetic systems, inspired by the prevalent unassailable cosmic theory, theory and system alike being petrified into rigid, sacrosanct tradition. Evolution comes about, if such a simile be permissible, in the form of a wave, so long as to appear flat.

Science, without the quickening influence of a critical method to test ever anew the foundations of belief, turns into erudition, dogmatic and fantastic; the originating thoughts fade away, leaving a mere empty husk behind. Individual initiative being crushed out by the pressure of convention, art sinks into craft, veiled in a nimbus of mysticism.

The pure impulse towards seeking the foundations of knowledge is choked by utilitarianism, and medicine, sharing the fate of culture as a whole, declines, untouched by that Promethean striving which is at once the curse and the blessing of the West.

If, therefore, all of thought and experience that the East has treasured up is to persist as a living force it must assume a new and flexible form. This change was effected on the free soil of Greece—a land untrammelled by tradition. Younger by thousands of years than Oriental lore Greek medicine appears on the horizon of history, heir to the primitive Mesopotamian and Egyptian tradition, yet parted from it by a world of thought—an organism of highest development, whose influence makes itself felt even to-day. With no intermediate phase it links the remains of Oriental literature to that matchless collection of writings bearing the name of Hippocrates, greatest of all physicians, which, as though in direct contrast with the hide-bound East, reveals in this one domain the whole beauty, the

entire freedom of Hellenic thought. Here the healing art is seen at a height to which only the greatest personalities can attain, here creative speculation takes its stand, not upon dogma but on critical argument, not on assertion but on fact.

The Hippocratic writings, seemingly the sole surviving monument of past ages, were for long held to be the beginning, whereas they were really the completion of Greek medical science which, striving ever towards the ideal, contained the germ of all future development, foreshadowed all future tendencies.

The historic process leading through centuries up to this result is even more hidden from our view than is the gradual evolution of Oriental thought to its apotheosis in Greek philosophy and art. We have as yet but a few stepping-stones whereby to trace the upward path leading from Oriental tradition through the early stages of Greek medicine to Hippocrates.

Just as the peculiarity of Greek culture lay not alone in racial superiority, but resulted chiefly from a remarkable concatenation of favourable circumstances, both of time and place, so also was the startling singularity of Greek medicine ultimately ascribable to those mighty influences making for beauty and freedom that inspired all cultured life in Greece. Greek culture was a stream fed by many springs. The strange "contingency of contraries" of all sorts and conditions was the very fountain-head of that marvellous plasticity which gave to Hellenic native genius and mental acquirements free scope for their clearly-thought, clean-cut creations. The light thrown by modern research on the rise of certain sagas and traditions (Cadmos, Danaos), on the origin of various cults (Cabeiri, Aphrodite, Adonis, Cybele), and the etymology of local names abundantly proves that, both during their early wanderings to Asia Minor and Greece and after their later settlement, the Greeks were strongly influenced by the civilisations of mightier surrounding nationalities. From the Macedonian landsmen, the Carian islanders and the Phœnician seafarers Greece received not only products of nature and manufacture but also many of the intellectual acquirements of Egypt and Mesopotamia.

The peaceful traffic in Sidonian wine bowls and Cypriote armour, in linen garments, garden plants and domestic animals brought with it Eastern weights and measures, Eastern handicraft, the art of writing, and even introduced various of the Eastern gods and cults to the world of Greece.

The heroic age of Homer is not that of childhood, but has a long retrospect of Mycenaean culture in the course of which ancient Indo-Germanic vigour strove for equality with Egyptian and Babylonian influences, while foreign elements under varying local conditions were assimilated into local tradition.

From a very early time, Greek character was marked by an ennobling

sense of beauty and an intelligence so wide, so clear, as actually to attain to a deep intuition of the immutable reign of law in Nature. These mental characteristics well befitted the bright sky, the clear air, the distant yet sharply defined horizons, the ever varied but always well-proportioned nature of Greek scenery. Thus it came that the heads of beasts fell from the statues of the gods ; that art began to seek the ideal in harmony of proportion rather than to strive after the sublime by means of fantastic exaggeration or colossal size and that the mythology of Homeric song subjects even the all-powerful gods to the inexorable will of fateful Moira.

With the rise of the Dorians and the Ionians, on whom the hegemony was later to devolve, the original uniformity of Achaian culture was exchanged for that individual development of cognate races to which the configuration of the country seemed to point, cut up as it was into numerous mountain-cantons, meet homesteads for a race strongly marked and self-sufficing.

Secure on one hand from foreign aggression, for which the comparative sterility of the soil and its protection by nature offered small temptation, preserved on the other from stagnation by the infinite variety of an encircling and indenting sea, which tempted the beholder to embark upon a life of enterprise and adventure, the national development advanced at a steady rate but at no dead level of uniformity ; labour became increasingly subdivided while the standard of mental capacity rose through the free inter-marriage of various classes—sailor, artisan, farmer, hunter and shepherd. These growing energies soon called for a wider sphere of action, and at an early period Greece was forced to extend her borders by colonisation, in order to provide for the needs and numbers of her teeming population.

As early as the eighth century B.C. the enterprising Miletus had established a factory on the Nile, and the same date marked the first settlements in Sicily and along the eastern borders of the Black Sea. In the seventh century colonists from Thera founded the town of Cyrene on the north coast of Africa and in quick succession a chain of settlements arose, extending from the far East to the Pillars of Hercules. Great as were the material advantages of these settlements as stations for sea-traffic and new markets for home industries, their reflex action on politics and opinion in the mother country was even greater. Through informing intercourse with home-coming merchants, colonists and adventurers, knowledge of many distant nations was diffused, many varying opinions were spread abroad. These were the outcome of a fierce struggle for existence under new conditions, of impressions produced by critical comparison of foreign

customs and foreign rule, and not least of the intermingling of heterogeneous races. This greater breadth of outlook led to innovations in every sphere, or at least shook belief in illiberal traditions; politically it found expression in the transition of monarchy through oligarchy and tyranny into democracy.

The newest settlements being the most progressive, culture attained its highest development in the great commercial centres that had arisen in Ionia, then the link connecting Greece with Egypt and the further East. The coast population of Asia Minor, made up of every Greek race, and crossed by Carian and Phœnician strains, coming into close touch with Eastern civilisation on the frontier line of Lydia and Phrygia, was the first to receive Babylonian weights, measures and astronomical instruments, in return for Grecian culture. In Ionia, poetry—epic, elegiac and lyric—found its birthplace, and music, under Phrygian influence, received new-born inspiration; it was also in Ionia, exactly on the crossing of Eastern and Western ways, that the two great standards of value were discovered—one material in the coining of money, the other mental, in the art of criticism. The latter cleared the myth cycle of its legendary overgrowth (comparative criticism of the saga by Hecataeus), paved the way for the rational history of logographs, and penetrated to the very heart of things in the Theory of Knowledge.

Ionian natural philosophy, introduced, together with Babylonian astronomy and Egyptian geometry, by Thales, himself of mingled Greek and Phœnician descent, came at the right time to raise the banner of free thought in Greece, where, simultaneously with the introduction of foreign influences and the rise of democracy, a decided wave of mysticism had set in. Hesiod's Theogony, by imparting a greater gravity and higher morality to Homeric mythology, had raised the status of various superstitions, hitherto current only amongst the vulgar. The many temples, standing as masterpieces of seventh-century art, undoubtedly incited to religious fervour and thus encouraged the introduction of Eastern cults.

The subjectiveness, becoming more and more a distinguishing feature of politics, poetry and the representative arts, intensified the metaphysical longing for deities, who should not only be the guardians of the great, the community or the nation, but should be immediately accessible to the religious fervour of the individual. Public sacrifices, expiatory offerings and worship of the dead increased and multiplied; oracles rose in estimation; and religious longings found ever growing satisfaction alike in the pretensions to theological revelation of sixth-century Thracian Orphic symbolism and in the hidden mysteries of Oriental cults that showed forth in allegory the immortality of the human soul.

This wave of Eastern mysticism was met by an opposing one from the West, in the form of Pythagorean philosophy, a weird blend of mathematico-physical cosmic theory, belief in metempsychosis and Western mysticism combined with the Eastern phase of Buddha and Zarathustra. Thus in Hellas also were the seeds of superstition sown broadcast and the foundation laid of a Bastille for free thought—the builders alone were wanting.

One saving grace enabled first the Ionian, then the Eleatic philosophy successfully to combat this growing mysticism, by opposing to its theological assertions their cosmic theories, based on profoundest speculation and tested by severest criticism. They succeeded in securing to science her firm position as an independent sphere of mental activity, working on principles and by methods peculiarly her own and entirely free, untrammelled by religious tradition. That this profound cleavage was effected between East and West is due to the fact that in Greece no hierarchy had as yet arisen to claim rule and governance over the whole range of spiritual life. Greek science owed its rapid rise in part to the happy chance that enabled the Greeks, regardless of the barriers raised by dogmatism, to make free use of the speculations and remarkable achievements of the Babylonian-Egyptian priestly caste in mathematics, geometry, astronomy, natural history. Only thus could the contradictions between growing experience and hoary tradition be brought to light and finally disposed of by assured scientific means.

From want of a fixed political centre no hierarchy had arisen in Greece—as the cults of various races were gradually recognised by the state, their priests became state officials, subject to popular election. Religion itself, starting from no one point, and reaching no fixed goal, was a free amalgamation of racial cults which, without unassailable dogma or universally accepted written charter, received its stimulus rather through poetry and art than at the hands of the priestly caste.

The exercise of religion not being the privilege of a single class, the priests lacked the essentials of political predominance and therewith their rôle of spiritual leaders, which accordingly passed first to the rhapsodists and poets, later to philosophers. It was true indeed that at the close of the sixth and opening of the fifth centuries the mystical influence of the many wandering prophets, soothsayers and diviners seemed to have assured to the Delphic oracle the hegemony of the Hellenic world, and that already the Persian king cherished the hope of securing from the Delphic priesthood in Hellas the political service that spiritual authority had rendered him in Egypt and Judæa. The victories of Salamis and Plataea, however,

brought in their train the complete intellectual freedom of Hellas and made it impossible that, as in the East, science should be merged in religious dogmatism.

Of all these factors of culture those of greatest importance to the development of medicine were—firstly the early and continuous contact with the older Eastern civilisations, which secured to the Greek inquirer, without loss of independent judgment, a knowledge of drugs and methods from Egypt and Mesopotamia, together with many fundamental ideas of wide theoretical significance : secondly, the keen rivalry between the numerous centres of culture whereby the raw material of experience imported or self-acquired could be elaborated and individualised. The third and most important factor was the absence of a closed and learned priestly caste which, as ever and everywhere, would, by an infusion of religious doctrines, have brought science to a standstill. Thus it was that from the first throughout Greece, especially in places which were in touch with pre-Hellenic culture or commercial enterprise, the healing art rose above the level both of formal dogma and mere empiricism, that Greek medicine so early broke loose from the temple cult and under guidance of philosophy proceeded amid the free conflict of opposing empirical, speculative and methodical forces, to rear a synthetic organism of medical science.

With strong light there must also be deep shade. To Hippocrates and to him alone was it given to use freedom with discretion ; to recognise and with wise restraint make no attempt to overstep the limits of human knowledge ; to eliminate alike the dogma of caste and the element of uncontrolled speculation.

The tendency of Greek science was to seek advancement, not by discovery of isolated facts nor by unbiassed individual observations, but by leaps and bounds of intuition amounting to genius, the less stained by empiric dust the nearer to the ideal. The same artistic feeling that sought to hide all trace of servile toil in its creations inspired the scientific energy of the Greeks. Just as their plastic art at its highest represents the idealised type of humanity, but never the individual man, so did Greek investigation seek by means of a pliant fancy to reach the nature of things, before an even approximately adequate collection had been made of isolated facts, through which the general law might dimly be discerned.

Fully assured that a specious general view would automatically lead to detailed knowledge, philosophic thinkers, as though treating of mathematics or astronomy, used as premises for medicine intuitive ideals, *a priori* principles, and later even generalisations from physiology to pathology. Medicine, which still required a long course of empiricism,

had thus forced upon it the premature use of deduction as the one sovereign method.

Although we undoubtedly owe to classic antiquity a considerable number of exemplary methods of cure, a wealth of experience and many masterly descriptions of disease, although due attention was paid to methods of examination, it must yet be admitted that the aim and object of Greek medicine was less investigation than general speculation upon the nature of disease.

Thus the history of medicine is no calm unbroken evolution, but a series of advances by fits and starts, with interruptions of subjective influence, and with change of scene (Hellas, Alexandria, Rome), finally reaching its conclusion in the pompous, all-embracing compilation of Galen, and though at times inexperience showed herself mother of wisdom, yet many of the finest intellects squandered their energies upon grotesque error which obscured many valuable half truths.

The great ambition of all thinkers, to transform Hippocratic art into a systematised science, seemed to be fulfilled in Galen's monumental work, and for many centuries medicine was supposed to have reached its culmination in the great physician of Pergamos.

The corroding influence of time and progress has crumbled this mental edifice, leaving only so much standing as rested on actual experience and genuine biological knowledge. All else of its greatness and glory, its rational coherence through philosophical principles and dialectic acumen—the entire syllogistic fabric has perished, leaving the methodologic value alone unquestioned.

Never with greater sublimity, never with greater prodigality of intellect was indirect proof made of the fact that it is the most brilliant speculative systems which bar the way of progress, that *a priori* deduction, if not reconsidered in the light of experience, serves but to lead medicine astray.

Alike therefore by her actual achievements and by the disclosure of the sources of her errors, Greece has made posterity her eternal debtor.

HOMERIC HEALING ART AND PRIESTLY MEDICINE

OF prehistoric Greek medicine it may be conjectured that, Indo-Germanic in origin, it assumed the character of the Mycenaean epoch, adopting from neighbouring peoples the drugs and methods which trade with the seafaring Phœnician merchants had introduced into Greece. Empiricism and theurgy were the elements of these early beginnings, for, when medicine failed, it was replaced by prayer, invocation, sacrifice and other religious rites. Among the Greeks theurgy also developed into a system of temple medicine which, however, in no wise interfered or vied with the empiric art.

Homer gives the first insight into Greek medicine. His frequent battle-scenes afford opportunity for realistic descriptions of various bodily injuries and their approved treatment, (by means of withdrawal of lance or spear points, arrest of bleeding, application of anodyne drugs, dressings, reviving drinks etc.).

Though the brave heroes are spoken of as great alike in minstrelsy and healing, the Iliad alludes also to other physicians under the name of *πολυφάρμακοι*, and the Odyssey is even acquainted with professional leeches who like other demiurges (singers, seers, builders etc.) are called in and receive a fee for attendance.

The high estimation in which the healing art was held is proved by the famous line :

“ *ἰητρὸς γὰρ ἀνὴρ πολλῶν ἀντάξιός ἄλλων* ”
“ a physician outweighs many other men ” (in value).

Homeric healing art represents chiefly popular precepts and practice, characterised by acute observation and clear grasp of causes—except indeed where myth explanations were adduced to fill the wide gaps in knowledge then existing. This was mostly with regard to the rarely mentioned internal maladies which were, as a rule, attributed to divine wrath (plague, melancholia etc.). Homeric surgery displays astonishing exactitude in describing the after-effects of certain injuries. In cases where simple withdrawal was attended with difficulty the removal of darts was effected either by widening the wound or by cutting out the spear point : of surgical instruments the common knife alone is mentioned.

Pain-killers such as roots were applied either by sprinkling in powder form or as poultices.

A strengthening tonic for the wounded consisted of Pramnian wine, onions, honey, grated goat's-milk cheese and flour.

Homeric anatomical knowledge, possessing a nomenclature of one hundred and fifty words, was acquired partly by the sight of sacrifices (at an early period sometimes human), but mostly from observations made in attending injuries, more especially fractures and dislocations.

It was a deduction from experience, if an incomplete one, to look upon the life spirit (*θυμὸς*, *ψυχή*) as breath and to place it in the diaphragm (*φρένες*), a wound of which was known to be fatal.

Chief among healers in Homeric song were the great heroes who rendered each other aid : Achilles, who owed his skill to the wise centaur Cheiron ; Patroclus ; Nestor ; and more especially Machaon and Podaleirios, sons of Asclepius the Thessalian prince.

Women also are mentioned as physicians as well as nurses ; the sorceress Circe, the herbalists Agamede and Helen, the latter notably owing to Egyptian Polydamna her knowledge of many a drug, more especially of the healing draught (*φάρμακον νέπνυθες*) that drowns all pain and sorrow (probably opium).

Here let it be remarked how Homer, from his rich store of culture, hands down to all future time a highly developed popular system of medicine.

It is a surprising fact that the *Iliad*, while speaking of plague as sent by the wrathful Apollo and alluding to expiation, makes no mention of invocation or superstitious spells as means of cure. Pæon himself, physician of the gods, heals the wounds of Ares with balsam only. It is in the later *Odyssey*, representing a much more advanced stage of culture and the beginning of urban life, that spoken charms are first employed in the treatment of wounds (the episode of the boar hunt on Mount Parnassus). This fact may be taken as a striking proof that mysticism, as earliest stage of theory, follows and does not precede empiricism in historical succession and increases with progress of culture.

Piercing the veil woven around them by fancy we can plainly see the perfectly rational empirical meaning of Greek myths relating to medicine. The mythical Melampus restores power to the impotent Iphiclus by means of iron rust, and heals the three mad daughters of Proetus with hellebore, baths and exercise. The skin disease of Hercules is cured by sugar baths etc.

Ignorance, failing to perceive the connection between simple cause and effect, discovers in surrounding circumstances the origin of a miracle, and accordingly dresses it up in fantastic guise.

Thus it is that in post-Homeric literature, from Hesiod onwards, more and more frequent mention is made of superstitious methods, invocations, amulets, healing dreams, hurtful demons, etc., which gradually crystallised into a fixed system, more especially in the sixth century B.C. Orphic literature, with its tormenting omens, choice of lucky and unlucky days and mystic formulæ. This increase of mysticism was the natural result of growing Eastern influences, and the birth of religious views in the lower strata of the population. Belief in demons and magic by means of herbs, stones, words (Ephesian characters), amulets (in part relics of pre-Grecian fetiches) as guards from maladies and the evil eye, magic rings against

snake-bites etc., are expressions of this trend of thought, which prevailed up to the time of the Peloponnesian war.

Amid the many forms assumed by mysticism the dream-oracles were the chief; they were found mostly in places where the gods had made striking manifestation of their power and presence by strange natural phenomena, *e.g.* near caves emitting noxious gases; on islands subject to earthquake; in the neighbourhood of hot springs. Many of these oracles acquired medical fame through cures divinely revealed in dreams: among such holy places were Pluto's shrine at Acharaka in Lydia, where the dreams were sent, not to the patients, but to the priests; the miracle-working grotto of Trophonius at Lebadea in Boeotia, and particularly the ancient dream-oracle of the earth-god Amphiaraos at Oropos, which imposed on inquiring patients total abstinence of three days from wine and of twenty-four hours from food of any description. Near to this latter sanctuary was a well whose waters might be used for purification or sacrifice only by those whom the oracle had cured; in such cases it was customary to cast a gold or silver cup into the holy spring, and to dedicate images of the cured members as votive offerings to the god. These and other sanctuaries, however, were not exclusively reserved for the sick, who also might turn to any of the principal gods, Apollo, Artemis or Athene, their prayer for healing help. It was in post-Homeric times that the cult of a special god of healing arose, one whose sole office was the cure of sickness and the preservation of health.

This was the cult of Asclepios (Ἀσκληπῖος, Ἰατρός, Ὀρθιος, Παιάν), whose temples formed the chief and latterly the only seats of theurgic medicine, and were held in such estimation that they survived the Olympian fall.

As, despite Hesiod's systematising wisdom, Greek mythology continued to flourish, ever assimilating fresh matter by the historic joining of races and adoption of foreign elements, so also were the belief in and cult of healing gods subject to continual variety and addition. Medical mythology runs parallel with the greater differentiation of diseases and the greater subdivision of the profession. In earliest times the powers of healing, of life and death were ascribed to all gods alike. It was only later that certain divinities came to have a special connection with the healing art, either as a whole or in some well-defined branch. Among these were distinguished as the three chief (Τρισσοὶ ἀλεξιμοροί):

1. Apollo, the founder of medicine, yet bringing pestilence and death on man by his far-reaching darts (sun-rays), who was early identified with Pæon, physician of the gods.
2. Artemis, protectress of women and children, afterwards confounded with Eileithya of Eastern origin, goddess of birth.
3. Pallas Athene the Healer (Hygieia), worshipped under the name of ὀφθαλμίτις as guardian of eyesight.

Besides these the following are to be noted:—Aphrodite, Poseidon, in a lesser degree Hecate, Pan, Dionysos, Persephone etc.

Connected with certain spots or confined to certain classes was the worship of Hercules

(patron of athletes); Hector (in Thebes); Helen (goddess of birth of Spartan women); Amphiaraus at Rhamnos and Oropos; Aristomachus at Marathon; Polydamas at Olympia; the Scythian hero Toxaris at Athens, as also Amyonas and the heroes in general.

Of foreign origin are the mythical figure of Medea, the wife of Jason, from poison-bearing Colchis, Hyperborean Ole, Thracian Orpheus with Musæus his disciple, Zamolxis, Abaris and northern Aristæas, Scythian Toxaris and Anacharsis, possibly apotheoses of historic personages. The chief founder of medicine was held to be the Thessalian Cheiron, most just of all centaurs, who instructed the greatest Hellenic heroes in the arts of healing and the chase (hence the plant names cheironium, centaurea).

As told by tradition, another disciple of Cheiron's was Asclepius the son of Apollo, deified as god of medicine.

The Asclepius myth displays extraordinary polymorphism, arising as it did not only from the fabrication of priestly fables in favour of certain shrines, but also as the natural product of centuries of dissemination of legends, the ever-gathering additions to which spun a thick web hardly penetrable in the time of Strabo and Cicero.

Probably Asclepius was originally a chthonic race-god (Earth demon) of Thessaly, who like other local divinities, on the collection of separate myths into one common religion, was at first honoured only as a hero—Homer, Hesiod and Pindar do not speak of him as a god. With the later spread of his cult, and according to the universal acceptance of the miraculous in medicine he was advanced as son of Apollo to divine rank (as was Egyptian Imhotep as son of Ptah). His attribute of the snake and the dream-oracle attached to his temple point to a chthonic origin. The legend concerning the birth and parentage, life and deeds of Asclepius as well as his cult, embellished with Oriental mysticism, consists of an amalgamation of many heterogeneous elements, some relating to the Phœnician god Eshæon, others fantastically disguised reminiscences of real persons, others again pure allegories of medical art and natural healing powers. The earliest view represents Asclepius as son of Ischys the Elatide and Coronis daughter of the Heraclide Phlegyas. In Homer he is merely a hero, Thessalian king and father of the heroes Machaon and Podaleirios, who were skilled in the healing art and leaders of warriors who came from Ithome, Trikke and Oichalia to Troy. Later legends again make him a demigod. His father is Apollo, who either himself instructs him in the art of medicine, or commits him to the care of the centaur Cheiron on Mount Pelion for that purpose. The name of the mother varies with the different legends as the Asclepius cult passed into the Peloponnesus—some calling her Coronis, some Arsinoë, daughter of Arcadian Inachus, others Arsinoë, daughter of Leucippus in Messenia. Some tell how Apollo himself, or Hermes, ripped the child out of his dead mother, others how Coronis exposed her new-born infant on a mountain at Epidaurus, where he was nursed by goats, and watched by the shepherd's dog. This variation is due chiefly to the priests, whose interest lay in making shrine and birthplace coincide. (The legend of Epidaurus finally prevailed, as from the fifth century onward the Asclepian temple of that place eclipsed all others in power and glory.)

This legend ascribes to Asclepius many miraculous cures (of blindness etc.) and the introduction of music and gymnastics into medicine. His therapeutics would seem really to have consisted of surgical operations, baths, anointing and theurgy. On account of Pluto's complaints of his frequent restoration to life of the dead, Asclepius was slain by the avenging bolt of Zeus: another legend says that his greed of gold (payment for medical aid) brought upon him the wrath of the god: another that he died a natural death.

As regards birth, achievements and death Cicero distinguished three different persons in Asclepius. After death he was raised to Olympus, or placed as snake-bearer among the stars. In his temples, beside his own (Zeus-like) statue, various other figures were always found, personifying agents of health, such as heat, light, air, etc.

The very names of the wives and children of Asclepius are symbolic. As wife besides

Xante appears Lampetie or Epione. As children Hygieia, Euamerion, Aigle, Panacea, Jaso, Aceso, Janiscos, Telesphoras (in form of a boy with hood : probably derived from or identical with Egyptian Harpocrates), also the two Homeric heroes Machaon and Podaleirios.

In the Aethiopis of the poet Actinus Machaon appears as surgeon, Podaleirios as physician with the power "of knowing the invisible and healing the incurable." Both, probably historical, personages spread the worship of Asclepios, Machaon in Peloponnesus, his brother in Asia Minor.

Besides the usual animals, serpent, dog and goat, weights and coins are counted or represented as attributes of the god, also serpent-wreathed staff and laurel crown. Cocks or hens were his usual sacrifice.

The oldest shrine of Asclepios was at Trikka in Thessaly ; this, with those of Epidaurus and Cos and, at a much later date, Pergamos, were the most sought.

The cult of this young god, introduced only in 420 B.C. by Sophocles into Athens, where hitherto Amynos had been sole god of medicine, quickly spread through Hellas, chiefly by recommendation of the Epidaurian priesthood, who, at the foundation of each new temple, provided a serpent, symbol of the healing god. Most of these temples kept non-poisonous, tamed and trained snakes, which were often employed for all manner of jugglery. (When the question is raised as to the Egyptian origin of Asclepian worship it should be borne in mind that the snake or worm largely represents the Egyptian idea of disease.) Besides the many temples in Greece, there were in Italy those of Croton, Tarentum and Rome, the latter erected on an island of the Tiber 293 B.C.

It is remarkable that the Asclepios cult flourished mostly in places which, through climatic or hygienic advantages, were natural health resorts. Those favoured spots on hill or mountain, in the shelter of forests, by rivers or springs of pure flowing water, were conducive to health. The vivifying air, the well cultivated gardens surrounding the shrine, the magnificent view, all tended to cheer the heart with new hope of cure. Many of these temples owed their fame to mineral or merely hot springs. To the homely altars, erected originally by sacred fountains in the neighbourhood of health-giving mineral springs, were later added magnificent temples, pleasure-grounds for festivals, gymnasia in which bodily ailments were treated by physical exercises, baths and inunctions, also, as is proved by excavations, living rooms for the patients. Access to the shrine was forbidden to the unclean and the impure, pregnant women and the mortally afflicted were kept away ; no dead body could find a resting-place within the holy precincts, the shelter and cure of the sick being undertaken by the keepers of inns and boarding-houses in the neighbourhood. The suppliants for aid had to submit to careful purification, to bathe in sea, river or spring, to fast for a prescribed time, to abjure wine and certain articles of diet, and they were only permitted to enter the temple when they were adequately prepared by cleansing, inunction and fumigation. This lengthy and exhausting preparation, partly dietetic, partly suggestive, was accompanied by a solemn service of prayer and sacrifice, whose symbolism tended highly to excite the imagination.

These impressions were deepened by the sight of costly votive offerings for effected cures ; the tales of awe-inspiring priests who explained the inscriptions of the temple halls and described many previous miracles, excited greatest hope.

Thus prepared and raised to a high pitch of nervous tension the patient spent one or more nights in the Hieron, at the foot of great Asclepios' statue, awaiting the healing, god-inspired dream which fancy should weave out of these late solemn experiences. For as in the Amphiarion so in the Asclepion it was in temple sleep that cures were divinely sent (Greek *ἐγκοίμησις*, Latin, *incubatio*).

From inscriptions on the temple of Epidauros (with which the burlesque representations of Aristophanes, in his comedy *Plutos*, agree) we may gather that in earliest times the god himself effected the cure: *i.e.* that the priest, masked as the god, appeared by night (accompanied by priestesses posing as Hygieia, Jaso, etc.) and probably assisted by the putative descendants of Asclepios (Asclepiads), who were doubtless in league with the priesthood, actually performed cures which the half-sleeping or half-intoxicated patient imagined to be dreams (binding, anointing, taking or effect of medicines).

In later times Asclepios refrained from these manual services and only indicated the cure, either clearly or symbolically, to the dreamer or his accepted proxy.

The Asclepiads, so-called descendants of the god, severed from the priesthood, or at any rate from its mysticism, ceased to take part in this simple trickery, becoming independent physicians, consenting only at the express wish of patients to carry out the inspired prescriptions.

In the visions which required to be interpreted by skilled priests (*i.e.* to be brought into line with their medicinal system) Asclepios enjoined mostly rational cures, such as diet, exercise in riding, hunting, or fencing, also psychical means—listening to a song, seeing a play—less often bleeding or purgatives, at times seemingly ridiculous but really suggestive measures. Success was always ascribed to the credit of the god, failure to the fault of the patient.

The cured patient was bound to reimburse the priests and their god. In Epidauros Asclepios once himself claimed the fee with the words, "Thou art healed, now pay the honorarium."

In the ancient custom either "Anathemata" were offered in the form of effigies, gold, silver or marble, of the healed members, or coins stuck with wax on to the thighs of the god's statue, or cast as votive offerings into the sacred spring. In many temples the cures and the means employed were engraved on the pillars or written on votive tablets of wood and stone, and hung up on posts or pillars. In honour of the god festivals were held, *Asclepieia* by name, consisting of musical competitions.

The system of different Asclepiads varied according to the stress laid

on mysticism, or on rational treatment, *i.e.* according to the greater or less authority permitted by the priests to the Asclepiad temple physicians.

From this point of view Epidauros may be said to stand for thaumaturgy, Cos for rationalism. The former claimed pre-eminence, and from the fifth century onwards strove to eclipse all other temples of the god. As symbol of hegemony the ambitious Epidaurian priesthood presented holy snakes at the consecration of dependent shrines. Myth relates that the presentation to Cos failed of effect: the priests of Cos declared themselves in disagreement with Epidaurian methods, preferring the rational principles of therapy laid down by the investigations of their Asclepiads. The tablets of Cos must therefore have differed from those of Epidauros, whose contents, as so far discovered, point to the prevalence of darkest superstition.

Whatever the spirit of the therapeutic prescriptions, their practice was invariably theurgy—it was Asclepios himself who spoke through his priests. In spite of any use that may have been made of growing experience, officially the priest could recognise no collection of critical observations; each divine manifestation stood as a fresh miracle and in order to preserve an appearance of the supernatural the priests were forced to hand over the foundation of medical science to other men unconnected with religious cult. Thus, apart from the absence of a closed religious dogmatism, did the very subservience of the priests to their cult work out as a factor in aid of the free development of Greek medicine beside and outside the temple precincts.

THE PHYSICIANS

ASCLEPIADS, GYMNASTS, RHIZOTOMISTS

THE Asclepios cult was but one of many forms of the development of medicine ; arising at a comparatively late date it was soon opposed by cross currents of earlier origin, and from lack of a fixed universal priesthood as support and protection, it gained only temporarily, at least in the upper classes, that spiritual domination which theurgy assured to Eastern medicine. With the Greeks free art was more deeply rooted than obscurantism.

From Homer's time and onwards poets and historians make mention of lay physicians who freely exercised their profession untrammelled by temple medicine. In very early times the custom arose for communities to appoint official physicians whose duty it was, for a fixed salary, to attend the poor gratis, to make the necessary sanitary arrangements in presence of epidemics, and as experts to give evidence in court : it is equally certain that a medical corps accompanied armies and fleets (an innovation on the part of Lycurgus) and that Greek physicians accepted posts as court and personal medical advisers to foreign princes.

The medical profession, ranking as a trade, was open to any one boasting the requisite knowledge—women, indeed, were excluded and slaves might treat only their own class. This freedom enlisted the services of all grades of capacity, from the highest philosopher to the lowest mountebank.

Three types of physician are distinguished :

1. The simple practitioner (δημοιργός), regularly trained, working with an assistant.
2. The master (ἀρχιτεκτονικός).
3. The dilettante amateur (πεπαιδευμένος).

Strictly speaking only those ranked as properly qualified physicians who had undergone a course, practical and theoretical, under a recognised master. This diploma was essential in the case of official physicians (δημοσιεύοντες), *e.g.* in Athens, where, after presentation, the candidates were chosen by popular assembly.

Physicians practised either in their own homes or by going on circuit. Patients were treated either in their own houses or in medical "homes" (ιατρεία, ιατρικὰ ἐργαστήρια), which were also provided with sick-rooms for temporary treatment. Such "homes" were provided,

either at their own cost by the more eminent physicians who had assistants or scholars, or were kept up by the community for the use of the official physicians (inscriptions describing special taxes for this purpose are extant). These homes were employed chiefly for operations and contained all the needful instruments and appliances for such in their well-lighted rooms. The assistants and scholars who desired to obtain experience or perfect it stood round the master and were allowed to try their hands on simple (particularly non-paying) cases; sometimes also they accompanied the chief on his professional rounds.

On medical journeys a portable case was taken with indispensable instruments, bandages, ointments, plasters, emetics and purgatives. Such cases have been discovered.

Extraordinary services were rewarded with endowments, exemption from taxation, citizenship, decrees of honour, gold crowns, statues etc. For example inscriptions record such honour paid by their grateful fellow-citizens to Onasilos, Euenor and Menocritos.

As might be expected rational medicine found its most active centres in the colonies which came into closest touch with Asiatic and Egyptian influence, where philosophy flourished or temples of Asclepios stood. Among the former were Cyrene and Crotona—to the latter belonged the schools of Rhodes, Cnidos and Cos.

In the time of Herodotus the physicians of Crotona and after them those of Cyrene, were the most famous. Cyrene, capital of the Cyrenaica, derived her wealth from trade in silphium, an aromatic drug, borne in the city arms, and from early times she encouraged philosophy. Crotona, the seat of Pythagoreanism, possessed a school of medicine. The history of the short-lived Rhodes school is lost in obscurity.

The fact that a free rational medical school arose both in Cnidos and Cos, under the very shadow of the temple and yet untrammelled by priestly influence, will cause no surprise when it is borne in mind that this advance was made, not by the priests, but by the temple physicians, the so-called Asclepiads, who in historic times had little or no connection with temple cult, and could at discretion practise beyond the precincts and even in foreign countries. At any rate during the century preceding the time of Hippocrates the Asclepiads of Cnidos and Cos formed only a sharply-defined group of Greek physicians, distinguished from others by strict organisation, expressed in certain ordinances and formalities. The object of these was to admit into the Asclepiad guild only those who, closely bound together by common veneration of the god and like scientific views, made a high standard of medical activity their aim in life, binding themselves by oath to maintain the honour of the art, the ethics of practice, gratitude to teachers, brotherly love to the latter's children and finally, to preserve scientific secrets from profanation by the vulgar.

The trait of familial affection which shows itself clearly in the guild of the Asclepiads and the priest-like secrecy surrounding their doctrines (analogous with the Eleusinian mysteries and the Pythagorean bond), were founded on the tradition that the Asclepiads were originally a band

of brothers who, claiming descent from the divine father of medicine, guarded their art as a family inheritance. External influences caused this select union to extend its circle by admission of strangers (*ἔξω τοῦ γένους*) and so to become a spiritual family of physicians who retained under the mantle of venerable tradition the original purity of transmitted teachings, and manifested by various outward and visible signs their former connection with the Asclepiad priesthood.

The older historians of medicine identified Asclepiads with the priests of Asclepius. This view proving to be incorrect, some went so far as to deny that the two were in any way connected. The middle view is now taken of recognising the original connection of the Asclepiads with the priests, the co-operation of the "sons of the gods" in the earlier ritual observances, whilst assuming a gradual and complete separation of the Asclepiads from all temple magic particularly in Cnidos and Cos. The Asclepiads may possibly have been families in which from earliest times the medical calling had been practised and its secrets cherished as an inheritance: just as up to the present day there are families who for centuries in remote districts have practised either the entire medical art or some special branch, and who carry on ancient traditions. These medical families found symbolical expression in worship of the supposed ancestor (*ἥρωος κτίστης Ἀσκληπιός*), exactly as the smiths worshipped Hephaistos. With the growing numbers and importance of the family, to which strangers were gradually admitted under certain conditions, the race hero was raised to the rank of universal god of medicine, and the family cult became a national worship with temples and official priests. This process is proved by the fact that Asclepius becomes son of Apollo, and is worshipped with other gods of healing; that his statue is found with those of Apollo, Hygieia, etc.; that, as proved by excavations at Paros, he (possibly on the discovery of a new mineral spring) was admitted into the shrine of Apollo Pythios. The so-called descendants of Asclepius were partly merged in temple mysticism, partly, as in Cos, practised rational medicine, and even influenced the priests against miracle-mongering.

The temples offered favourable opportunities of seeing complaints of all kinds, of learning the effect of remedies and methods of cure, and of enlarging experience by the inscribed histories of diseases. The temple archives of Rhodes, Cos, and Cnidos contained rich libraries stored with knowledge for later generations. The Asclepiads practised either in the *Iatreia* or in the patients' dwellings; many also pursued their profession abroad—showing how little priestly exclusiveness hampered them. A dedicatory inscription in Athens proves that, as early as the sixth century, the Asclepiads of Cos were renowned for their capacity even in remote parts of Greece. Excavations of the Asclepieion of Cos undertaken in recent times demonstrate that it served as a record of renown of the physicians of Cos, and that the local Asclepiads were, despite their connection with the priesthood, rationally educated physicians who gladly pursued their avocation abroad.

In the earliest times the youth was instructed in medical art by his father or by some older relative; later, when the guild included strangers,

special schools for the Asclepiads were founded. In these sons of citizens received theoretical or practical instruction in all branches of knowledge, often in return for the payment of a large sum. The sons of Asclepiads received gratuitous instruction, as the students, after a prolonged course, had in turn to bind themselves to teach their art without reward to the sons of their masters.

The instruction included the structure and function of the body—we have the testimony of Galen that the disciples of Asclepios were early initiated in anatomy. Later they proceeded to learn the causation of disease, which was supplemented by practical teaching on the different maladies and their treatment, illustrated by individual cases as these came under observation in the Iatreion. The more advanced pupils were allowed, under the supervision of their teachers, to handle the cases themselves. Completed education was followed by admission into the guild of the Asclepiads, an oath being taken, binding the new member for ever to maintenance of the scientific and ethical traditions.

The oath, which has come down to us through the Hippocratic Collection, runs as follows: "I swear by Apollo, the physician, by Asclepios, by Hygieia and Panacea and by all the gods and goddesses, calling them to witness that I will observe this my oath and carry out these my undertakings to the best of my power and understanding. I swear to honour him who has instructed me in this art as I honour my parents, to share his fate and, if occasion arise, to provide him with the necessities of life. His descendants shall be as my own brothers, and I will, if desired, teach them the art without money and without bond, imparting precepts, lectures and other knowledge to my sons, to my masters' sons and to the students admitted according to the laws of medicine, but to none other.

"I will employ dietetic measures to the use and profit of the sick, according to my capacity and understanding: if any danger and hurt threaten I will endeavour to avert them. I will yield to no entreaty to supply a poisonous drug nor give advice to him who demands it.

"Nor will I give to any woman the means of procuring abortion. I will order my life in purity and piety and so practise my profession. Also I swear by the gods to cut no one for stone, but to leave this operation to those whose profession it is.

"However many houses I visit, it shall always be to the advantage and profit of my patients, and I will hold myself aloof from every intentional and injurious evil, in particular from sexual relations with men and women, free or slaves.

"I will keep silence on that which I hear or see in the course of treatment or in everyday life, which should not be repeated, holding such to be a secret. If now I keep my oath may I enjoy a happy life and a prosperous practice and be held in esteem for all time by all men, but if I break it may the opposite happen."

The mysticism of the Asclepiads diminished on the one hand in proportion to the admission of strangers into their fraternity, whereby the preservation of professional secrets was relaxed, on the other through intercourse with physicians (particularly Pythagorean), who had derived a more extended outlook from the schools of philosophy or who by empirical capacity had earned the confidence of the people. Philosophers, such as

Pythagoras, Empedocles and their pupils, who were not without medical knowledge or dexterity, proved that healing was to be found even remote from the Asclepian shrines. Philosophically educated physicians aroused by their speculative and theoretical writings—and a considerable medical literature was in existence long before Hippocrates—general scientific interest.

Sophists, too, ready of speech on any subject, driven by greed of fame or gold, were not backward in exposing their dilettante knowledge to the clear light of day by means of public discourses, whereby medical skill, judged from a lay point of view, suffered not a little through their ignorance.

The Asclepiads, as their oath shows, resigned many operations, which from insufficient anatomical knowledge and technique could only be undertaken in the crudest manner (castration and lithotomy), to the “handicraftsmen” and denied their assistance to certain undertakings (abortion) which seemed to these medical eclectics inconsistent with their professional honour. Quacks and empirics, hangers-on, gladly took their place and, possessing nimble wit rather than knowledge, acquired a considerable following through their readiness to undertake forbidden or doubtful procedures.

These empirics, who occupied themselves chiefly with specialities (bladder-operations, eye and tooth troubles), form a transition stage to all kinds of dilettanti who, originally subordinate assistants to qualified physicians, gladly undertook the physicians’ rôle themselves, lauding their insufficient methods or manipulations as infallible panaceas with all the fanaticism typical of narrow-mindedness.

Amongst these must be reckoned the gymnasts, *i.e.* the teachers and leaders in the schools of exercise who, as *Iatraliptes*, also undertook the *inunction* of the body.

In view of the important place that these gymnasia occupied in the public life of Greece, it is not surprising that the gymnasts who, in cases of injuries, fractures or dislocations, were called upon to render first aid before the arrival of the physician and who apparently possessed the greatest experience of the healthy influence of the method of life, and of bodily exercises, soon were looked upon as genuine physicians. Consulted upon diet and gymnastics by sound and sick alike, many of them overstepped the bounds of their legitimate sphere, and pretended by systematic bodily exercises and dietetic rules to be able to cure diseases, particularly chronic ones. Credit must be given the gymnasts for the fact that they appreciated, earlier than the Asclepiads and the professional physicians, the significance of cures by physical exercises and tissue change. Half educated,

however, they employed dietetic means, inunctions, steam baths, massage and body movements for all possible conditions and with ill-judged exaggeration recommended cures to their patients better suited to the training of robust athletes than to the treatment of disease.

Like certain modern miracle-workers, many gymnasts appealed to personal experience and carried on a successful propaganda by means of sophisticated writings, *e.g.* Ikkos of Tarentum and Herodicos of Selymbria. The latter's favourite prescription consisted of fatiguing walks (*e.g.* from Athens to Megara and back without a halt—5½ miles) and he sought to reduce fever by running, wrestling and external warmth. His cure of dropsy (purgation, emesis immediately after eating, and warm fomentations) was recognised even in later times. The system of Herodicos and the empirical use of gymnastics were founded upon a partial truth which later was recognised by rational medicine.

In order to obtain a complete picture of the Greek healing world, a glance must be thrown upon the rank growth of charlatans, recruited from amongst those who, with intent to deceive, played upon the credulity of the masses and knew how to adopt impudently the methods of legitimate practitioners. Besides the quacks and shepherds the so-called rhizotomists and pharmacopolists played a leading part in Greece. The physicians of olden days mostly prepared their medicines themselves, but made use, naturally, of assistants whose business it was to collect the plants, to separate them into their constituent parts, and to prepare, *secundum artem*, the leaves, blossoms, roots or juice. According to their chief occupation, the collection of roots, such persons were called rhizotomists. Many of these, however, did not confine themselves to their own business but made use of the scanty pharmaceutical and medical knowledge they had from time to time gleaned in a reprehensible manner, surrounding themselves with a nimbus of mysticism by means of various superstitious procedures most useful for their purposes.

More dangerous were the druggists, who not only exposed for sale in their shops the raw materials, but also curiosities, medicines prepared by themselves, secret remedies, beauty potions and poison, wherewith they did a flourishing business as quacks.

It would be a matter for surprise if "wise women" and midwives were not included in the confederation of charlatans. Although Greek women were excluded from the practice of medicine, yet in secret they were able to carry on their trade, the more easily in that their way was paved by the sense of shame of the sufferers. These "women doctors" occupied themselves chiefly with the preparation of love- and beauty-potions, but

did not refuse their advice in really serious gynæcological diseases. As in all times, the midwives did not confine themselves to the care of the pregnant, to assisting the parturient with speech, song, incantations and drugs, or to cutting the umbilical cord, but with reprehensible enterprise undertook gynæcological and pediatric operations ; additional sources of profit were abortifacients, procuring and matchmaking.

COMMENCEMENTS OF MEDICAL THEORY

COLLECTION and observation of facts constitute the first step in science, but not science itself. The economic requirements of the human intellect necessitate a grouping of isolated facts from different points of view; the thirst for knowledge renders imperative a clearer insight into the laws governing natural phenomena. Long before the requisite conditions for a methodical deduction of first principles from the raw material of medical experience were so much as outlined, keen, far-seeing thinkers had attempted to add the leaven of science to a scanty empiricism by introducing into medicine as guiding principle the elements of a cosmic theory in accordance with which facts known or unknown had to appear as logically inevitable inferences.

The priest-physicians of the Egyptian and Mesopotamian civilisations brought their medical theory into line with the tenets of their dogmatic cosmology; Greek medical thought drew its inspiration mainly from the fluid principles of philosophic speculation with its daring and far-reaching conclusions. Even though it thus became the sport of every phase of mutable opinion, the disadvantage of instability was far outweighed by the immeasurable advantage of constant criticism derived from the fluctuation of systems and partly at least the result of empirical investigation into natural phenomena. The pre-Socratic philosophers cloaked the results of experience which, if limited, were at least certain, with what were apparently pure intuitions, and strove, not only for analysis of the world of ideas, but by preference for comprehension of natural science, including the construction, development and activity of organic life. They were investigators of nature, many of them even physicians who, dominated by conceptions of an all-embracing harmony, eagerly drew general deductions from particular experience. Biological research, cosmology and dialectics were all points on the circumference of a circle, the starting-point being taken at will.

One or two empirical principles supporting the earliest systems of natural philosophy may be mentioned.

When Thales of Miletus (624-548 B.C.) held water to be the primary matter from which

all things were derived, his view may have arisen from consideration of the fact that moisture is indispensable to vegetation, that rainfall and inundation (the Nile) promote fertility, that the nourishment of plants and animals is moist, and so on. The doctrine of Anaximenes (b. between 528 and 524 B.C.) or later of Diogenes of Apollonia (ca. 430 B.C.) that air is the original source of all can be supported by the observations that air is universally distributed, that respiration maintains life, that winds exercise the greatest influence upon temperature, growth and health. It was also a genuine, if one-sided, observation which led Heraclitus of Ephesus to conclude, from the constant synthesis and analysis in nature, that fire, the "matter" that appears never to rest, that produces change in state of fluids, gases and solids and which further is the underlying principle of the vital warmth of highly-organised life, should constitute the primary matter. The significance of the vital warmth is also recognised by Parmenides of Elea, who held the warm to be the fundamental principle of life, and man to have arisen from clay vitalised by the sun's heat. Anaxagoras of Clazomenae held that the elements fire, water, air, earth, in his day considered simple, were in reality most complicated substances, full of "seed" of every imaginable kind; he believed that there were as many primary substances as modifications of matter evident to our senses, these substances consisting of infinitely small, unalterable particles (*e.g.* gold of gold particles, silver of silver particles). The source of this grotesque error is to be sought in the fact that the philosopher took nutrition as the starting-point for his observations and deduced that as manifold structures, skin, flesh, blood, hair were produced from food, this must already contain invisible particles, *e.g.* in bread, water, meat etc. must be minute particles of flesh, bone, blood etc. which, under favourable circumstances, come together in the nutritive process. Empedocles of Agrigentum (ca. 495–435 B.C.) assumed a limited number of primary substances—fire, water, air and earth—the union or separation of which and the quantitative conditions of their combinations lead to the existence of the different objects in nature. In order to make the doctrine of mingling of elements understood, he refers by way of illustration to the mixture of colours on a painter's palette. His four elements he compares to the four primary colours (white, black, red, yellow), the graduated mixture of which produces an infinite number of different tints. Herein it may also be seen how this thinker takes his stand upon definite observation and we may assume that his universal law "Like is known by like" rests upon observation of homogeneous matter in large quantities (air, earth, sea, clouds).

It may here be pointed out that the different phases of Hellenic speculation are a reflection of the philosophic principles of Oriental nations: thus the mathematical conception of the universe of Pythagoras and many peculiarities in his ethics are reminiscent of Chinese philosophy; the Eleatic doctrines suggest the Vedantic philosophy of the Indians; the four-element doctrine of Empedocles and the system of Heraclitus have much in common with the philosophies respectively of the Egyptians and of Zoroaster.

Pythagoras takes the first place amongst those philosophers who exercised the earliest and most lasting influence upon medicine. The sage of Samos who, after much travel for the purposes of study (to Egypt and probably Babylon), founded a guild in Crotona, religious and moral, did pioneer work, not only in mathematics, astronomy and acoustics, but also in investigation of the structure of the body, reproduction and development, the functions of the senses and mental activity, as well as in the treatment of the sick. The most noteworthy of the theoretical results of his investigations was that he denied the origin of life from decomposing matter, asserting the necessary existence of an embryo. He also clearly differ-

entiated mental affections, whereby the localisation of the intellect in the brain was foreshadowed.

The Pythagorean system, according to which all natural processes are governed strictly by law and by a definite numerical relationship, coincided so readily with the belief in critical days that the latter was naturally fathered upon him.

Pythagoras and his pupils, amongst whom were many physicians, whilst neglecting most surgical procedures, employed as remedies simples, poultices, salves and theurgical usages (expiations, spells, magical herbs, incantations, religious music), particular stress being laid upon regulation of the habits of life and physical exercise (employment of gymnastics and certain dietetic measures such as a limited consumption of meat, interdiction of fish and beans, were amongst the most important prescriptions of the Pythagoreans).

After dissolution of the order, in consequence of political events, about 500 B.C., many physicians educated in the spirit of the founder were scattered abroad throughout Greece; the medical school of Crotona was undoubtedly in touch with the Pythagoreans.

The development of medical theory owes much to a younger contemporary of Pythagoras, the deep-thinking philosopher and physician, Alkmaion of Crotona. His writing upon nature (*περὶ φύσεως*), unfortunately lost at an early date, constitutes the beginning of Greek medical literature. He has the credit of being the first to introduce abdominal section, of being the discoverer of the optic nerve (wrongly also of the Eustachian tube); he distinguished in the cadaver between empty veins and veins containing blood, and was familiar with the air passages. He considered the determination of sex to depend upon the predominance of the male or female element and taught that the head was the first part formed to enable the mouth to absorb nourishment in utero. Alkmaion explained sleep as a damming back of the blood in the blood-conducting vessels; owing to the disturbances of the senses occurring in concussion of the brain, he imagined that blindness and deafness occurred from obstruction to the sense conduction through dislocation of the brain from its normal position.

He opposed the universally accepted notion that the semen emanated from the spinal cord, by the actual observation that an animal killed after the sexual act showed no diminution in the amount of the spinal matter. The most important contribution of the great discoverer, however, is the fact, which he was the first to establish, that the brain is the central organ of intellectual activity. Health, according to him, is conditional upon

the equilibrium of the material qualities present in the body (cold, moist, warm, dry, sweet, bitter); sickness results through the predominance of one quality, cure from a restoration of the balance, through the addition of the opposite one.

Philolaos, who developed the teachings of his master, is remarkable amongst the adherents of Pythagoras on account of one or two physiological and pathological principles. The distinction between sensory, animal and vegetative functions and their localisations, later more definitely stated by Plato and Aristotle, is also indicated by him. He localises the "human" element in the brain (which is the seat of the intellect), the "animal" in the heart, and the "vegetable" (growth) in the navel; the functions of insemination and procreation lie in the sexual organs. The body is formed from the warm, the breath causes cooling. The causes of disease are bile, blood and phlegm. Predispositions to disease are excess or lack of warmth, nourishment, etc. Inflammation arises from accumulation of phlegm—in itself warmth-producing.

The theory, opposed by the Pythagoreans, that health depends upon harmony, or as Alkmaion puts it, upon a maintenance of equilibrium between different qualities, is only a particular application of the general idea of conflict and reconciliation of opposites throughout nature. This idea recurs in the speculations of later philosophers and maintains its position with great constancy.

The table of contraries, a doctrine derived from Babylon, plays a considerable part in the Pythagorean system. In pursuance of its teaching a further series of contraries arises from the opposition of the limited and the unlimited, the straight and the crooked, the one and the many, right and left, good and evil etc. In this connection may be indicated the dualism in the Persian religious system, in Chinese natural philosophy and the recognition by Heracleitos in particular amongst Ionic philosophers of the coexistence of contraries and their union into "invisible" harmonies.

According to Parmenides, who looked upon the warm as the bearer of life, the sex of the foetus depends upon the preponderance of the male or female element; boys spring from the right testicle and the right half of the uterus, girls from the left; the female sex is the warmer; men arise in the north, women in the south. The cosmology of Parmenides lays stress upon the co-operation of opposites in light and darkness, emptiness and fulness etc.

Empedocles limited the number of contraries, laying stress only upon the antitheses warm—cold, moist—dry. Corresponding with these (instead of the single primitive substance of Ionic natural philosophy or of the countless ones of Anaxagoras) he supposed four elements to exist, fire, air, water and earth, to which he ascribed the possession of a soul.

The qualitative difference between things is solely brought about by the union, in ever varying quantitative proportions, of the four intrinsically unalterable fundamental qualities—(e.g. flesh and blood contain equal

proportions of the four elements ; bones, on the other hand, are $\frac{1}{2}$ fire, $\frac{1}{4}$ earth, and $\frac{1}{4}$ water). As the human body, in common with all bodies in nature, consists of the four primitive substances, so health is conditional upon their equilibrium, disease upon their disproportion. These views of Empedocles in a modified form permeated physiology and pathology up to the threshold of modern times.

Empedocles was physician, seer, priest and statesman in one. Honoured as a god by his contemporaries, his influence made itself felt throughout Hellas, his life, his deeds and his death being surrounded by a halo of myth. "In a purple robe, gold-encircled, long hair framing his gloomy countenance, crowned with the priestly laurel, he travelled through the country districts of Sicily, surrounded by a host of worshippers of both sexes. Thousands, even tens of thousands acclaimed him, prostrated themselves before him and demanded of him favourable forecasts for the future no less than healing for all manner of disease." He freed the town of Selinus from a devastating scourge by reclaiming the swampy land and he assured his native town of Agrigentum favourable climatic conditions by blocking up a rift in a hill.

The impression that his exceptional deeds made upon himself may be summed up in the words spoken to his followers: "I am an immortal god in your eyes, no longer a mortal." He died at the age of sixty in a foreign land, the Peloponnesus, as the result of an accident—according to a legend he threw himself into the crater of Mount Etna.

Empedocles is on the one hand a mystic, on the other he approaches in many things to the most modern views upon a mechanical conception of nature. Such are notably his fundamental principles which bear a close resemblance to chemical laws: *e.g.* assumption of a definite number of elements, composition of all bodies out of the elements in varying proportions, explanation of qualitative differences by quantitative variations.

Most important is his doctrine of forces. Two main forces rule the world, love and hate (*φιλία καὶ νῆκος*). These in alternating supremacy shape the construction, development and decay of all creations, and carry on the manifold processes of genesis and dissolution, leading now to union of dissimilar elements, now to destruction of organisms, each constituent particle then seeking its own element following the law that "like seeks like," air to air, earth to earth.

The law of the attraction of likes and the assumption of the existence of pores (canals) as means of communication between the inner and outer world was elaborated by Empedocles in the physiology of the senses. Emanations from light- sound- and odour- producing substances stream through the pores of the body and are appreciated by their likes, *e.g.* the visible (light—fire, dark—water) is attracted by the fire and water particles of the eye, sound is caught in the labyrinth, the discovery of which is credited to Empedocles, and is dependent upon the pores through which it moves. His theory of respiration also rests upon a physical basis, it

being supposed to occur through the skin as well as through the lungs. He here institutes a comparison with the water-clock or with the fact that a vessel whose mouth is carefully closed with the finger and so placed in a basin of water does not, on removal of the finger, fill with water owing to the obstruction of the air, though otherwise the water would at once enter. In the same way the air penetrates the lungs and pores if the blood, the carrier of animal warmth, withdraws into the inner parts of the body. It is driven out again to the surface by the subsequent return stream of blood : the regular backward and forward flow constituting the respiratory rhythm.

In surprising anticipation of modern ideas, Empedocles stated that living beings are derived from the growing together of incomplete structures and separate members whereby only intrinsically congruous combinations are capable of existing and of being propagated—a fantastic representation which contains not only the germ of the evolution-idea, but, like Darwinism, refers teleology simply to the “survival of the fittest.”

Touching embryogeny this philosopher believed that the embryo was completed in the uterus within forty days, the heart being the first organ formed. Sex is determined by the preponderance of male or “female” semen or by the presence of cold or warmth on the part of the parents ; if the woman nourish herself upon cold and moist food a daughter will be born ; twins are due to the presence of a large amount of semen in both horns of the uterus. Prominent pupils of Empedocles were the physicians Pausanias and Acron of Agrigentum ; the latter wrote a treatise of dietetics for healthy people, combated an epidemic (according to Plutarch the Athenian “plague”) by means of funeral pyres and as a physician pure and simple preferred empiricism to speculation. It is, no doubt, due to this fact that Acron was ridiculed by Empedocles in a comedy and was later known as the founder of the sect of Empirics.

Anaxagoras of Clazomenæ, a contemporary of Empedocles, teacher of Pericles and celebrated through his Homoiomereian Theory as well as by his assumption of a future spiritual life, belongs to those philosophers who, like Heracleitos, practised dissection of animals, following the illuminating example of Alkmaion. Anaxagoras laid the foundation of dissection of the brain, recognised the lateral ventricles, and mentioned as a pathological fact the discovery of a single ventricle in a one-horned deer.

The brain he supposed to be the first organ developed in the embryo.

This philosopher’s teachings upon disease are characterised by a theory that recurs perennially throughout later medical speculation, viz. that most acute affections are caused by bile—of which he distinguished two varieties, black and yellow—which permeates the blood and organs.

The chief founder of the Atomistic Theory, the much travelled Democritos of Abdera, the renowned teacher of Leucippos, exercised a great influence upon both theoretical and practical medicine.

Tradition assigns to Democritos the position of the most important forerunner of Aristotle in the domain of scientific empiricism, and his system in its ramifications constitutes down to the present day the starting-point of all real investigation into natural philosophy; he described experience as the ultimate source of our knowledge of nature.

Democritos busied himself with zootomy and even published an original investigation into the anatomy of the chameleon: he added to existing knowledge upon the physiology of the senses and reproduction.

It is noteworthy that he paid attention to the pulse, explained inflammation as an accumulation of phlegm and considered hydrophobia to be an inflammation of the nerves. The widespread appearance of epidemic disease was, according to his theory, due to the disseminated atoms of shattered heavenly bodies.

Of those who carried on these teachings may be mentioned Hippon, Archelaos and particularly Diogenes of Apollonia, many of whose ideas are to be recognised in the medicine of this epoch.

Hippon, ridiculed by the poet Kratinos as the "all-seer," was not, on account of the barrenness of his speculations, admitted by Aristotle amongst the philosophers—but must rather be considered an empirical investigator. His system, which strove to unite the teachings of Thales and Parmenides, considered "the moist" as the fundamental status of nature from which were derived "the cold" and "the warm" (water and fire). The soul he described as humour derived from the semen. Sickness was explained as dependent upon excess or lack of humidity, but also upon its thinness or viscosity.

Archelaos of Athens, a pupil of Anaxagoras, combined the teachings of his master with the speculations of several precursors, laying down that the fundamental principle, air, the seat of the intellectual faculty, gave rise to warmth and cold by its condensation or rarefaction—two qualitative conceptions which frequently recur in contemporary and later physiology and pathology.

Diogenes of Apollonia resembles Anaximenes even more than does Archelaos in making air endowed with reason the origin of bodily and mental life. (This theory is held up to ridicule in the "Clouds" of Aristophanes, where Socrates is suspended over the earth in a basket in order to inhale the purest air and at the same time the clearest intelligence.) The identification of life (which cannot exist without air) with thought underlies this pneumatic theory. Air is the vehicle of sense-appreciation, the sensory nerves lead the impression received to its proper sensorium, the brain. The air mingling readily with the blood causes by its accelerated motion a pleasurable sensation; the opposite conditions give rise to pain.

Diogenes was familiar with the pulse and paid great attention to the blood vessels which were supposed to convey the air to the different parts of the system. It may here be mentioned that the earliest descriptions of the blood vessels have come to us through Aristotle, from Syenesis the Cypriote and from Diogenes of Apollonia. Although extremely confused, the latter's description already marks an advance, although it does not yet recognise the heart as the starting-point of the vessels.

The fruitful intercourse between philosophy and medicine had no little influence upon the trend of medical theory, and gave a bias to the whole later development of doctrines concerning pathogenesis.

The origin of disease was referred mostly to the disturbance of equilibrium

between the primary constituents of the body, to the preponderance of one of the elementary qualities and thus to a quantitative disproportion. Whilst this theory arose as a sequence from the cosmogony of the nature philosophers, a second, parallel hypothesis, which derived disease from abnormalities of the body fluids, found more support from empirically observed facts.

Although some of the above-mentioned philosophers sought the causation of disease in qualitative changes (*e.g.* excessive thinness or viscosity of the humour—Hippon), in abnormal accumulation of the tissue-juices (Philolaos, Democritos) or finally in their retention where they should not exist (*error loci*), yet such ideas upon humoral pathology necessarily arose out of medical experience.

Repeated observation taught that improvement commenced, fever and pain ceased and cure resulted as a consequence of expulsion of mucus or pus, of eructation or vomiting of bitter, sour or salt fluids, of purgation or of venesection. How easily then was the deduction made—*post hoc ergo propter hoc*—that all diseases are caused by altered, increased or abnormally situated humours.

Since the deciphering of Egyptian Papyrus No. 137 in the British Museum we can be assured that the humoral pathology with many modifications had a long evolution period before receiving definite shape in the Hippocratic schools. In the papyrus is incompletely represented the historical work of Menon (a pupil of Aristotle) and it contains in a most primitive form the views of some of the precursors and contemporaries of the Hippocratic school.

The starting-point of humoral pathology was the fact, partly derived from experience, that digestive disturbances precede or accompany most diseases. Therefore many of the old-time physicians ascribed a pathogenic rôle to waste products of food, or rather to the subjectively and objectively appreciated bitter, sour, acid or salt fluids thereby formed. According to Herodicos of Cnidos, diseases depend on the one hand upon the fluids arising from a disproportion between food intake and body movement and on the other upon the situation in which they lodge. Alcamenes of Abydos and Timotheus of Metapontum declared that the fluids mount to the head and thence are distributed throughout the body. If the viæ are obstructed by the influence of temperature or by injuries, salt or acrid fluids result which may break out again in various places and give rise to different affections according to the locality. Abas explained disease as caused by an excessive excretion of the brain through the nose, ears, eyes and mouth, whereby arose five different forms of catarrh.

According to Ninyas the Egyptian, who distinguished between inherited and acquired diseases, the latter are a result of waste products of digestion remaining in the body.

As the large number of indefinite qualities of dry, moist, warm, cold, salt etc. recognised by Alkmaion shrank after Empedocles to the canonical number four, so the tendency amongst physicians can be traced gradually to substitute for an indefinite number of pathological humours the abnormalities of a limited number of vital body fluids as causes of disease.

Those coming mostly into consideration are blood, phlegm (sputum, nasal secretion, saliva), water and bile, of which last two varieties are afterwards distinguished, black and yellow.

That the conceptions of humoral pathology—then as now—appeared plausible in the eyes of the people or even sprang from medical folk-lore is proved by their presence in Greek lay literature. “Black bile” was known to Aristophanes. The idea of black bile was a false deduction from real observation, *e.g.* the black colour of vomit or fæces. This view may have received support from the fact that in the coagulation of blood—venesection being an ancient custom—four different portions were distinguished, being taken according to colour, the blood-serum for yellow bile, the bright red clot for blood, the dark almost black portion of the same as black bile, the watery portion as phlegm.

The next step made by medical theory, in order fully to identify itself with philosophical speculation, was to bring into relation with one another the four primary fluids and the four elements. That is to say that four cardinal fluids were postulated (generally blood, phlegm, yellow and black bile) which represent fire, air, water and earth, or warm, cold, moist and dry, as special modifications of matter.

As may be seen from the above we only possess a very meagre insight into the pre-Hippocratic era and confine our quotations concerning it to those found in Aristotle and other authors. It can, however, clearly be recognised that medical thought was kept in a constant state of fluidity by the quickening influence of the philosophers, an activity shown in the abundant medical literature, which even included popular works. The fifth century was an epoch when Greek specialised authorship extended itself over every domain of human activity, from cookery and agriculture to the building of towns and stage management. Medical literature at this period, according to the tribute of Xenophon, enjoyed an extended popularity. Unfortunately nothing of this has come down to us with the exception of the Hippocratic Collection. This stands majestically apart, like some grand building, although the busy streets and precincts which once led to it have vanished.

MEDICAL SCHOOLS

CNIDOS, COS, THE SICILIAN SCHOOL

THE collection of writings ascribed to the greatest of physicians, Hippocrates, enables us in some degree to follow the trend of early Greek medical thought. In the Hippocratic Collection are found traces of Egyptian¹ and Mesopotamian medical art as well as ideas emanating from the genius of the great philosophical thinkers. The two schools of the Asclepiads at Cnidos and Cos are also represented, as well as the Italian-Sicilian school existing under the influence of the philosophers.

At the risk of anticipating historical events, we will illustrate the most prominent peculiarities of these schools, so far as our scanty information allows, before considering Hippocrates in the narrower sense.

The school of Cnidos, a Lacedæmonian colony in Asiatic Doris, appears to have been older than its rival of Cos.

In addition to quotations of a later date we have a criticism out of the mouth of a representative of the school of Cos. This recognises that the Cnidians gave accurate descriptions of "the suffering of the patient in each disease and the outcome of some of them." The authors of the "Cnidian Sentences," however, are sharply blamed for paying greater attention to the abnormal subjective sensations of the patient than to the objective results of the physician's examination. It is also said of them that they differentiated a large number of types of disease according to unimportant symptoms and fortuitous characteristics; that single cases were, without individualisation, arbitrarily brought into line with such types; that they neglected diet and employed a small number of remedies in stereotyped fashion (in chronic affections exclusively purgatives, milk and honey). Strictly speaking, the criticism does not refer to the entire Cnidian school, but only to its chief work the Cnidian Sentences, whilst their unfriendly critic himself says that "those who later revised the Sentences have given some further medical instructions as to the remedies to be employed in given instances."

¹ Recent investigations have shown prescriptions in the Ebers papyrus identical word for word with others in the Corpus Hippocraticum.

In consideration of the fact that this scientific opponent admits the progress of the school (in the second edition of the Cnidian Sentences) and after examination of those writings of the Hippocratic Collection which quote Cnidian research, we can pass a more favourable judgment upon the tendency of Cnidian medicine and may come to the following conclusions. The Cnidian, like the Egyptian and Mesopotamian physicians, distinguished a large number of syndromes as independent types of disease: their pharmaceutical formulary was very comprehensive, particularly in the domain of gynecology: local seems to have taken the place of individualising constitutional treatment.

Galen reports that the Cnidian physicians distinguished seven diseases of the bile, twelve of the urinary bladder, four of the kidneys, and a like number of varieties of strangury, three forms of vertigo, two diseases of the thigh, five of the feet, four anginas. From the Cnidian writings in the Hippocratic Collection it may be concluded that three forms of vertigo were recognised (the supposed cause being either secretion of mucus from the nose, loss of semen or over-filling of the spinal column with blood and bile), several forms of pleuritic effusion, three diseases of the liver, five of the spleen, three varieties of ileus etc.

The endeavour of the Cnidian physicians, under the influence of humoral speculation and anatomical thought, was directed upon converting the crudely regional determination of the seat of disease into a local pathology in keeping with their predilection for topical methods of treatment. Cnidian classification was built up on a foundation of excellent individual observations, on a due regard for ætiological factors and was inspired by recognition of the fact that similar symptoms may be called forth by totally dissimilar pathological processes. Owing, however, to the low grade of anatomical knowledge and the lack of insight into the connection between physiological functions and their disturbances, the ideal striven after was one which could only in very small part be realised.

Misled by speculation upon disease origins (wherein phlegm and bile played the chief rôle), with the help of seemingly accurate details concerning symptoms (wherein essentials were not distinguished from accessories nor causal relationships recognised), a host of clinical pictures was evolved, most of which were purely hypothetical and lacking in the true essentials of disease entities. As has so often occurred in the history of medicine error, more dangerous than crudest empiricism, masqueraded as knowledge, and was a stumbling-block in the way of unbiassed observation. Worse than the fantastic doctrinaire descriptions of disease in which mere variations passed as independent types, was the neglect of the individual peculiarities of each case. This merit, however, belongs to the Cnidians, that in their striving after more accurate diagnosis they made every possible use of

the senses and increased in a wonderful way the means of clinical examination. It follows with certainty from many writings emanating from their schools, and is in contradiction of the above-mentioned blame of the Cnidian Sentences, that they attached peculiar value to the subjective examination of patients. Auscultation in chest affections was known to them and they attained considerable proficiency in gynæcology.

Their therapeutic methods, in accordance with their ideas upon localisation, appear to have been mostly topical, more radical than expectant and individualising. With knife and cautery to hand they were nothing loth to perform excision of a rib in empyema or nephrotomy in renal abscess and did not hesitate to order excessive purgation, dietetic cures or exhausting walking exercise. Amongst their favourite prescriptions may be reckoned milk—particularly of a woman who has borne a son, exactly as in the Ebers papyrus—whey and barley made into flour by various methods, with or without additions. The following therapeutical methods were evolved from a physical and topical point of view : injection of fluids into the air-passages to produce coughing, inhalations to promote the expulsion of mucus or pus from the lungs, application of leather bags for the purpose of fomentation, swinging movements etc.

The school of Cnidos was undoubtedly much in debt to its contact with the East, traces of which were to be found in its leaning towards dream interpretations and in the symbolic designations of their scientific terminology. Later, however, it seems to have had close relationship with the great nature philosophers, especially with those of greater Italy, whence it undoubtedly derived its predilection for anatomical studies and for problems concerning the structure of the body. It is characteristic of the Cnidian thinkers that they made great use of far-reaching analogical deductions, particularly those drawn from comparison of bodily with cosmic processes or from the phenomena of plant and animal life. Physical parallels were most frequently drawn.

Amongst the numerous physicians of the Cnidian school two contemporaries of Hippocrates, Euryphon and Ctesias, stand pre-eminent. Euryphon undoubtedly exercised a far-reaching and lasting influence upon the development of medicine. He most probably took a considerable part in the compilation of the Cnidian Sentences and, indirectly at least, inspired the Cnidian writings in the Hippocratic Collection. Quotations from the later literature show that Euryphon practised anatomy, wrote a book upon "livid fever" (πελινή νόσος), explained pleurisy as a lung affection and treated phthisis with asses' or human milk and with the actual cautery. It is perhaps this last method which is referred to in a scene from the humorist

Plato in which a consumptive, Kinesias, appears with scars of burns upon his chest. It is further in evidence that he considered the causes of disease to be insufficient evacuation of waste-products of digestion and their determination to the head. He taught that hæmorrhage could occur from arteries as well as veins (in contrast to the prevailing teaching, which denied that arteries contained blood). Euryphon's profound insight into the nature of medical art proves experience to have been his teacher.

Euryphon busied himself also with obstetrics and gynæcology. Diagnosis of fertility he established by a fumigation; expulsion of the placenta he attempted by diuretics or by tying the parturient woman to a ladder and shaking it; uterine prolapse he treated by hanging the patient head downwards over a ladder and letting her fall back. Like the gymnast Herodicos he treated dropsy by blows from distended bladders.

Ctesias lived long at the Persian court and was instrumental in spreading much of the lore of the East by writings upon Persia and India. It is known of him that he published a work upon the use of hellebore in medicine and in a polemic against Hippocrates denied the possibility of permanent reduction of a dislocated hip.

Ctesias, who was a contemporary of Xenophon, served in the army of Cyrus against his brother Artaxerxes Mnemon, was taken prisoner by the latter and for seventeen years was held by him in high esteem on account of his medical skill.

Another Greek physician, Polycleitros of Mende, lived at the same time at the Persian court. Ctesias collected, during his sojourn in Persia, a rich store of historical and geographical notes, which he made use of in his works *Ἰνδικὰ* and *Περσικὰ*, of which many fragments have come down to us. He says of hellebore that its dosage was, in his father's day, little known and warns patients therefore of the frequently fatal effect of this drug.

From the school of Cos sprang the greatest of all physicians. If it owes to this happy chance a renown which puts all other schools in the shade, its traditions and achievements, on the other hand, are so stamped by the genius of the incomparable Hippocrates and the merits of the Hippocratic brotherhood that it is, in the present day, difficult to do justice to the school itself.

What we shall have to say later upon the knowledge and art of the Hippocratic school may by implication be taken as true also of the Coan. Here we can only touch generally upon the scientific attitude of its adherents in contradistinction with that of the Cnidians. That such a contrast should so early have developed itself between two schools of the Asclepiads and that, in the same epoch, in spite of fundamental intellectual affinity and greatest neighbourliness, Cnidos and Cos should, through their principles, have set up a standard for all future medical evolution, speaks more eloquently than anything else for the unequalled versatility of the Hellenic intellect.

The Coans, like the Cnidians, had as their ideal the elevation of medicine above a crude empiricism. With as keen an appreciation of the value of symptomatology as the latter, the description of the natural history of disease seemed to the Coans less the end and aim of medical thought than the fate of the sick individual; prognosis was rated higher than diagnosis. Whilst the Cnidians, by means of vague differentiation, built up numerous types of disease, the Coans sought to unite the same by the common bond of prognosis, seeing in atypical symptoms a varying course and outcome of the same complaint; their pathology and therapy were based less on the site of the disease than upon the general condition of the patient.

Mistakes were made on both sides, by the Cnidians through fictitious types of disease founded upon unessential characteristics, and by the Coans through fusion of clinical entities both pathologically and ætiologically distinct. From the point of view of theory, however, the first place must be accorded to the Coans, since in their time any real recognition of fundamental pathological processes was impossible; from the point of view of practice, because their methods led to individualised treatment.

Although the Cnidian classifications of disease possessed an air of scientific reality, the limitations of pure science rendered it impossible to do more than found a prognosis by the aid of a critically enlightened empiricism upon certain symptoms known by experience to be favourable or unfavourable.

It is historically remarkable that this phase of medical thought, the cult of prognosis, can be almost directly traced back to the medical lore of the temple soothsayers (divine omens, however, being replaced by vital manifestations of much greater import to the suppliants), and presents an analogy with the prediction of celestial phenomena and omens by the priestly astronomers of Babylon. These discovered from ancient records the law of periodicity in cosmic processes, and a Thales was hence able to predict an eclipse of the moon to the astonishment of his fellow-citizens. In like manner Asclepiads were enabled, through accumulated experience obtained by comparison of similar clinical records preserved in the temple archives, to establish signs of favourable or unfavourable omen, and empirically to formulate laws concerning the course of disease.

Favourite subjects of observation were those acute illnesses (such as pneumonia) which, by the type of their symptoms, by the rhythm of their course, hinted at a law reminiscent of the sidereal cycle, or of the numerical relationship of tones discovered by Pythagoras. Speculation and actual experience went hand in hand. Through observation of the complete clinical picture of typical diseases in their course, perhaps partly also

from astronomical study and Pythagorean number-mysticism arose the doctrine of crises and critical days. In addition to the state of the general health and various other indications, fever and the nature of the excretions and secretions served as guiding principles in clinical predictions. According to the prevailing humoral doctrine these were looked upon as "materies morbi" expelled from the system and their varying consistency demonstrated the proportional admixture of the elemental fluids. Upon analogy drawn from daily life and digestive processes the coincidence of rising or falling temperature with excreta of greater or less concentration was taken for the result of a process of coction of the vital juices by the body warmth. Three grades of disease were thus evolved: the stage of raw juice (ἀπεψία), the stage of coction (πέψις), and the stage of crisis (expulsion or removal of the materials of disease).

The experience and opinions of the Coan physicians were, before Hippocrates' time, embodied in the Coan "Doctrines," which were most probably used as the groundwork for one or other of the writings upon prognosis in the Hippocratic Collection.

If the Coans were imbued with the spirit of temperate clinical observation, and the Cnicians followed a trend which was indeed along the lines of experience, but which led them to sacrifice truth to nature upon the altar of impermanent scientific precision, the Sicilian medical school, as founded by Empedocles, appears to have had as its aim the attempt to convert medical art into science, to arrive at first principles by way of natural philosophy and philosophic speculation, from whence the theory of disease and the basis for medical treatment were deduced.

Acron and Pausanias, the pupils of Empedocles, and especially Philistion of Locroi, the contemporary of Plato, were the most prominent representatives of the school known as the Sicilian Physicians. From the scanty fragments which sharp-witted investigators have, in later times, rescued from obscurity, it becomes clear that these rendered great services to anatomical and physiological progress, and laid the most important foundation stone of the edifice of medicine whose superstructure was raised by the Hippocratic body. The most notable physicians of the Sicilian school, following in the footsteps of Alkmaion, devoted much time to animal dissection, wherein they paid particular attention to the vessels.

The teaching of Empedocles that the blood is the seat of inherent warmth (soul) and that respiration occurs, not only through mouth and nose, but also by way of the pores of the skin, through the tube system of the whole body, doubtless stimulated investigation by dissection. (It may be recalled that the philosophic protagonist of the pneumatic theory,

Diogenes of Apollonia, has left behind a description of the vascular system.)

In the opinion of competent investigators the best anatomical treatise contained in the Hippocratic Collection—upon the heart (*περὶ καρδίας*), with an excellent description of the aortic valves, pericardium and pericardial fluid—shows the influence of the Sicilian school; as with the Egyptians the teaching here represented is that the heart constitutes the centre of the vascular system and the source of all blood. Anatomical observation of the emptiness of the arteries after death, as well as general scientific considerations upon the significance of the air and of wind-movements, may have brought it about that Sicilian physicians looked upon the *pneuma* as the most important regulator of organic life. The *pneuma* was supposed to be distributed through the veins, to circulate with the blood, to temper the heat of the body, to assist all sense impressions and movements and, by stimulation of putrefactive processes, in conjunction with warmth to aid digestion. The heart was regarded as the central organ of the *pneuma*.

This doctrine, founded upon anatomical knowledge (heart the central point of vessels), was a momentous one for physiology and pathology in so far as the Sicilian school—in contrast to Alkmaion and the Coans—located the seat of the soul in the heart and looked upon mental disturbances as heart affections, an important retrogression which, as with the Cnidians, was caused through apparent accuracy.

In the doctrines concerning disease equal stress is laid upon the *pneuma* and the four elements or elementary qualities. As long as the movements of the *pneuma* (respiration) continue undisturbed the individual remains in good health; if they are hindered by obstruction through accumulation of bile or phlegm disease sets in. In addition to external influences (injury, temperature), or errors of diet, excess or lack of one of the qualities (warm or moist) may lead to illness.

In the matter of therapeutics the Sicilian school deserves recognition for laying particular stress on diet—a legacy from Pythagoras. The leaders Acron and Philistion published original works upon the subject; the latter was even included by Galen among the putative authors of the Hippocratic writings.

In this description we have carried the account of the Sicilian doctrines, not over the epoch in which the “Hippocratic” writings originated, but well beyond the time of the great Hippocrates himself. This overlapping was necessary in order to demonstrate the foundations of the “Hippocratic” writings towards which, with the teachings of the Cnidian and Coan schools, those of the Sicilian were not the least contributions.

It may be added that, at the time of Hippocrates, there lived physicians of no particular school. Meton of Athens, known as an astronomer, sought to connect medicine with astronomy. Bolos wrote upon the healing power of nature. Diagoras of Melos, opponent of the use of opium, discoverer of a collyrium for chronic catarrh of the eyes, was punished with banishment for atheism.

THE HIPPOCRATIC WRITINGS (CORPUS HIPPOCRATICUM)

THE renowned Hippocratic Collection of writings, preserved as the most ancient memorial of the golden age of Greek medicine, marks the point of intersection of all previous tendencies and unites in itself interwoven threads which stretch backwards into the mists of antiquity and forwards into the present day.

Tradition assigns this origin to one man, Hippocrates, the incomparable physician of Cos, who has inscribed his name in letters of fire upon the dark wall of time. In the light of searching criticism, however, the "works of Hippocrates" are nothing but the motley heterogeneous output of generations, the intellectual product of many thinkers whose individual voices only chance has united to form a single chorus, by no means invariably harmonious.

As it now appears the Hippocratic Collection was brought together and edited in the beginning of the third century B.C. by a commission of Alexandrian scholars under orders from the book-loving Ptolemy. Even at that time doubt existed as to which of the writings could with certainty be ascribed to the great Hippocrates, and hardly one of the books had remained free from alterations and additions. Endeavouring on the one hand to unite the genuine books in a single collection, anxious on the other to lose as little as possible, the commission did indeed sift the great mass of anonymous putative Hippocratic documents collected by merchants of all nations. They went about it so uncritically, however, that the Corpus Hippocraticum contains mere compilations and scanty extracts or fragments in conjunction with masterpieces hall-marked with the true medical spirit and classical literary style, Coan writings with those of other schools.

The individual works show the greatest differences amongst themselves in dialect, style and construction, even in respect of fundamental theoretical conceptions. Fully elaborated treatises are associated with mere collections of notes, clinical histories and specialised writings with verbal sophistries directed to the general public, whilst in the matter of origin a not unimportant part of the Collection does not emanate from the Coan

school at all nor even from the Hippocratic era, but is the product of earlier or later periods.

Since the time of the Alexandrian librarians erudite investigators have busied themselves with the question as to which writings are those of Hippocrates himself, and to which authors or schools the "false" books are to be ascribed. As no author is mentioned by name throughout the whole Hippocratic Collection, reliable contemporary evidence in favour of their genuineness is wanting, and the ancient commentators seized the opportunity of supporting their own medical convictions by the so-called "genuine" writings. Subjective criticism has thus freer scope since, unfortunately, distinguishing characteristics in textual criticism, etymology and technical facts are unreliable or even wholly wanting. It is a regrettable circumstance also, that the very facts which we are not in a position to infer from the Collection, viz. the personal theoretical views and knowledge of Hippocrates himself have biassed judgment, and the critics, assuming the ideal greatness of the Coan physician, have only too easily succumbed to the temptation of regarding as genuinely Hippocratic that which corresponded with contemporary conceptions of finality in medicine.

Although the problem of the authenticity of the Collection has been for two thousand years attacked by numbers of investigators, applying the most varied tests, unanimity of opinion has hardly been attained concerning any one writing. The wide range of opinion is shown by the fact that the number of "authentic" writings (of which the commentator Erotianus in Nero's time recognised thirty-one and Galen thirteen) has sunk to two or even to nil, whilst modern criticism admits no more than six.

The same holds true of the question concerning the authorship of the spurious books. The only definite conclusion arrived at is that the Hippocratic writings were published almost entirely before the time of Aristotle and covered a period of over a century. The Coan school exercised a predominating but not an exclusive influence upon their contents, whilst not a few of the writings show the impress of the doctrines and achievements of the Cnidian and to a lesser degree of the Sicilian schools.

This scanty result bespeaks a hiatus which, while disconcerting to the literary historian is of less importance in a retrospect treating rather of facts, ideas and general scientific development than of personalities.

It was, nevertheless, the Corpus Hippocraticum which in its entirety constituted the source of inspiration for countless physicians, whilst it influenced all theory and practice throughout the course of two thousand years, and this mass of thought and applied knowledge lies open to us untouched by any doubts cast upon its authenticity. Although the his-

torical Hippocrates is hidden from our view, the intellectual personality which diverted medical investigation from the devious path of speculation into the straight road of unbiassed observation, and imbued medical art with a recognition of its professional dignity, speaks from even the least of the writings, if unequally, yet with no uncertain voice.

Plato's Dialogues and Xenophon's representation convey different impressions of Socrates, so do the "Hippocratic" writings contain now more now less of the spirit of Hippocrates, but probably none of them are quite uninfluenced by his genius.

Without therefore entering into the niceties of philosophic criticism, we will first take the writings of the Collection into consideration and attempt to discover wherein lies the deeper meaning of Hippocratism, finally passing in rapid review the material content of the writings.

HIPPOCRATES

“Theory is the flower, not the root of experience.”

THE collection of Hippocratic writings gives little clue as to their individual authors, nor do they indicate the personal labours and opinions of Hippocrates, appearing, as they frequently do, contradictory in theory and even in practice.

This fact, however, stands out clearly, that the individuality permeating the whole Hippocratic writings and assuring them a place apart from all other medical literature, can be traced to the strong influence of a single dominating personality.

It is not the collected experience nor the wealth of ideas which distinguishes Hippocratic medicine from that which preceded it and from the later development of the art. It is neither doctrines nor knowledge which raise the Hippocratic creed to the highest pinnacle of Greek medicine and even make it the well-spring of medical science for all time : it is the conception of the medical vocation and the method of medical thought and action, true now as then.

It may be that deeper investigation will show that the details of medical knowledge and its application as presented in the Hippocratic collection owe their origin to the distant past and are loans from foreign civilisations. It may prove impossible narrowly to define the extent of the knowledge and art peculiar to the Hippocratic school. The monumental figure of the great Hippocrates, however, upon his serene height, remains undisturbed by such controversies, the embodiment of a new era in Greek medicine, the symbol of the highest ideal in medical ethics, the pattern of unbending austerity of thought in medical research.

True greatness sinks itself in its creations. The animating power of the immortal physician can be estimated by the fundamental differences between Hippocratic medicine and medicine before his day. We recognise his personality illuminating the pages of the works which bear his name ; his informing spirit breathes throughout history—but the historical Hippocrates himself we know far less than we do the traditional conception of the

Hippocratic creed, and only scant and legendary is our knowledge of the life and history of the imperishable master.

According to the most widely accepted view Hippocrates (known as the "second" in distinction from his grandfather of the same name), was born B.C. 460 or 459 upon the island of Cos. He was the son of the Asclepiad Heracleides and of Phænarete (or Praxithea, daughter of Phænarete) and traced his descent on his father's side from Asclepius, on his mother's from Hercules.

His first medical instruction was from his father, in the traditions of the Coan school—according to the Iatrika of Menon he was also influenced by Herodicos of Cnidos, not otherwise known to fame. To quench his thirst for knowledge and to gain varied experience as a physician, he undertook a journey throughout Hellas, in the course of which he is said to have come into contact with the gymnast Herodicos of Selymbria, the celebrated rhetorician Gorgias and the philosopher Democritus. The Hippocratic writings certainly contain references to localities, but these statements can hardly be considered as reliable indications of the places visited by Hippocrates in his wanderings and in which he practised his art, since a number of the writings are probably spurious, whilst many of the communications concerning medical matters are based upon second-hand information. Hippocrates certainly visited the island of Thasos, where there was an ancient Asclepiad temple, and stayed in different parts of Thessaly (notably Larissa and Meliboia), Thrace (Abdera), and the Propontis (Cyzicos). Possible, though unproved, is his sojourn in Athens, and particularly that on the sea of Azov, in the land of the Scythians, in Asia Minor, in Egypt and Lybia—suppositions based upon the celebrated book, *De ære, aquis et locis*. The great Coan ended his eventful life at Larissa, most probably in 377 B.C. In addition to his two sons Thessalos and Dracos, who also undertook journeys, his son-in-law Polybos, with Apollonios and Dexippos of Cos, probably also Praxagoras of Cos, ranked as his most famous pupils. It has been shown that Polybos took part in the formation of the Collection and acted as deputy in the school. Amongst the successors there were five who bore the name of Hippocrates and represented themselves as medical authors.

In his lifetime Hippocrates was already held in high honour—he was placed by Plato upon an equality with Polycleitos and Pheidias—after his death his fame grew in such degree that it outshone that of all previous and subsequent physicians. He was the physician *κατ' ἐξοχήν*. Even in Aristotle's time he was known as "the great," by Galen as "the divine," and down to the present time as "the father of medicine." His country-

men, the Coans, honoured his memory on the 24th of the month Agrianos, and in the second century A.D. the tomb of Hippocrates was still shown between Gyrta and Larissa.

Tradition says that a swarm of bees settled on it, whose honey was efficacious against thrush in children.

The achievements of Hippocrates' family, of the Coan school, of many of his predecessors and immediate successors, all these were placed to the credit of the one man, whilst the historic personality was more and more veiled by the nimbus of homage. Undiminished, ever rejuvenated, his fame survives the vicissitudes of time. Every nation distinguishes its greatest physician by the honourable title of Hippocrates. Medicine is called after him the Hippocratic art and, the highest compliment, he lives, as is proved by the literature of every country, in popular consciousness as the incomparable, unapproachable physician.

The period of Hippocratic influence coincides with that of the highest development of the political, scientific and artistic life of Hellas, with the time when "the tree of mankind was in full flower." It is the epoch which brought forth the statesmanship of Pericles, the philosophy of Socrates, the historical writings of Thucydides; the era of Sophocles and Euripides, of Pheidias, Polycleitos and Praxiteles; of Polygnotos, of Zeuxis and Parrhasios. Never before nor since has so confined a space in so short a time contained such a wealth of intellect and nobility. The liveliest representation must fall short of a reality where the only bounds to creative energy were those of symmetry, beauty and harmony, and where the rights of the individual were only restricted by the interests of the community.

Individualism was in every domain the guiding principle of action.

Under the protection of civic freedom the artist, unhindered by the fetters of conventionalism, dared to represent objects as he saw them; the poet, the philosophic thinker made bold to plough the soil even of the most sacred tradition with unrestricted criticism. In place of the rounded and complete cosmogony of earlier civilisations arose a subjective assurance of personal individuality; mythological types appeared in a new light; accepted beliefs were subjected to dialectic analysis; sophisticated rhetoric announced the relativity of all knowledge. In the drama, where the chorus had since the time of Æschylus been losing its significance, and in historiography the rights of personality grew in strength; the comedy of Aristophanes, the art of painting acquired truth to nature and faithfulness of portraiture, and the same free artistic taste which endowed sculpture with life, movement and expression, altered even the stiff formality of clothing and permitted to each the enunciation of his own individuality.

Whilst leading to highest development in art, individualism in science proportionately to its lack of positive facts brought in its train the most pronounced scepticism. Criticism, having vainly tried to reconcile the new knowledge with the ancient tradition, directed itself with the utmost

acerbity against the new-born, ever changing doctrines and views, wherein the element of caprice had frequently to be eliminated.

Natural science, no less than mental, was in a state of unstable equilibrium and in no subject did speculation run to such violent extremes, despite a surprising amount of progress standing to its credit, particularly in mathematics and astronomy. Upon this extreme followed a period of reaction, upon assurance disillusion, leading gradually from criticism to relativity and finally to the absolute negation of all certainty of knowledge. The dramas of Euripides give insight into the upheavals which shook prevalent cosmic theories to their foundations, dramas of a poet who, beginning as the protagonist of innovation, ended by proclaiming the bankruptcy of knowledge. Metrodoros of Chios, Democritos' most famous disciple, denied the possibility of knowing anything with certainty; the Heracleitean Cratylos would venture upon no judgment since the reality of existence was not to be established.

The prime movers in the intellectual upheaval whereby problems of every kind came to the surface—religious, moral, scientific—were the Sophists. These were masters of the art of stimulating thought, of offering, with subtle dialectic skill, clear-cut definitions, of improving, to an extraordinary degree, scientific phraseology, but, like the mediæval schoolmen, they believed themselves able to dispense with empirical knowledge, saw no difference between their hair-splitting, abstract verbal analyses and antitheses actually occurring in nature and, through their predilection for the formal, counted argument and rhetoric as science.

Little salvation in such chaos was to be looked for from peripatetic hiring teachers, alike devoid and contemptuous of real knowledge, who made it the height of their ambition to earn facile applause by their capacity speciously to defend the pro and contra of any question.

The age of simplicity, of untutored empiricism was past and to no purpose did the orthodox and political reactionaries in league with hypocritical demagogues endeavour to set back the clock, to decry, by the mockery of Aristophanes, the spirit of innovation and enlightenment or even to arrest progress by the banishment of certain philosophers. The one hope of victory over scepticism lay in this, that Individualism should in the sphere of morals expand the single self into the common whole, should intellectually advance to that conception of things as phenomena which, recognising the limitations of human understanding, is content with the perception of the senses and seeks only the common bond of law. This is the path trodden by Hippocrates.

In the maze of contradictions it seemed as though all knowledge born of experience must be lost, and thinkers saw themselves actually confronted with the alternative of renouncing the search after true knowledge or returning to a belief in tradition. The world of intellect owes to Socrates the act that emancipated it. A disciple of the Sophists, he yet overcame sophistry, the attractions of dialectics did not rob him of his feeling for reality, receptive of fresh impressions he did not discard the old, ever distinguishing between real knowledge and pretence he built up where others destroyed. Socrates also, more clearly than his predecessors, realised the limitations of knowledge, the relativity of our perceptions; a master of controversy, he ruthlessly exposed the fallacies in accepted beliefs, yet, unlike others, was not content with half measures. He limited investigation to the study of "human affairs," applied a standard to thought, discovered a moral law in the heart of man and recognised the reality of ideas conditioning phenomena (laws).

Thus in his cosmogony individualism becomes altruism, the happiness of the one being identified with the welfare of the many, and in spite of the admitted insolubility of the problems of natural philosophy with the means at the disposal of contemporary investigation, he did not draw the conclusion that all endeavour to understand nature was of necessity

unprofitable, but rather urged his disciples to undertake research so long as practical purposes were served and genuine experience formed its groundwork.

What Socrates was to philosophy, Hippocrates was to medicine. In both is embodied the reaction of practical reason against shallowness and theoretical excess. Both, in the midst of obscurity, morbid speculation and fruitless hypercriticism, stand for the golden mean in thought, leading to naked truth. Both, with a wise self-restraint, keep within the bounds of their respective domains, their activity centring around moral law and a highly idealised utilitarianism.

Greek medicine had, in the middle of the fifth century, arrived at a critical point, where a leading spirit was imperatively called for.

Favoured by the fullest intellectual freedom, which gave the widest scope to subjectivism, a rapid succession of diverse hypotheses, borrowed from natural philosophy, had not only taken possession of doctrines of disease, but had even brought the active practice of medicine into a dangerous dependence upon unstable systems.

The continual succession of speculations bolstered up by sophistry endangered the store of certain knowledge and experience, laboriously accumulated, and shook belief in the art of healing as such. It also paved the way for that unprofessional element which, like the gymnasts, laid disproportionate value upon individual methods of treatment, vaunting each as a panacea, or like the peripatetic teachers, seeking renown, befooled the public with empty rhetoric. Iatrosophists upon one side, fanatical empiricists upon the other, strove for mastery and already it seemed inevitable that medicine should lose itself in a sea of speculation or be overwhelmed in a waste of barren formalism.

Temperate medical observation, associated with careful reflection based on fact, found its home almost entirely in the schools of the Asclepiads. There, venerable tradition, whilst by no means shutting out recent innovations, knew how to confine speculation within reasonable limits. In order to fulfil their great mission, to keep within bounds the clamour of the fashionable philosopher-physicians and the quackery of the conscienceless criers in the market-place, it was essential that the wisdom of the Asclepiads, garnered through generations, should be purged of the last trace of its esoteric eclecticism and that their knowledge, their methods and their ethics should become the common property of the entire medical profession.

Many preparatory events led to this exploit, brought about eventually through Hippocrates, the greatest of the Asclepiads.

In his person Hellenism, so far as medicine is concerned, first showed, not only that it had freed itself from the fetters of oriental dogmatism, but

also from the leading-strings of the priestly caste and was capable of climbing alone the steps of rational science and moral dignity.

The transition from the guild of the Asclepiads into the free profession of medicine makes comprehensible the essential peculiarities of Hippocratism.

The two first writings of the Hippocratic Collection are like stepping-stones marking the transit: "The Oath," the oldest inheritance from the Coan school, wherein are laid down the duties of the Asclepiads towards teacher, pupil and patient; and "The Law," which alludes in its conclusion to the consecration preceding admission to the guild. Others of the writings also breathe the Hippocratic conception of medical duty, and a special place is reserved in them for ethics and medical etiquette, whilst they concede to deontology the position of an integral portion of medical instruction. Apart from the reaction against the vagaries of many of the profession, this fact is emphasised, that it is precisely the free physician—more than the priestly or semi-priestly member of a guild—who needs to be imbued with a sense of the responsibility of his work and of the duties of his profession, in order not to overstep the barely defined limits set to his professional activity.

The writing "The Physician" begins thus: "Touching his state of mind he must be heedful of the following. He must not only know how to be silent at the right time, but must lead a well-ordered life, for this adds much to his good repute. Let his disposition be that of a man of honour and as such let him behave to all honourable men in a friendly and easy spirit. Precipitation and impetuosity are not liked even though they be of use. As to his bearing, let him wear an expression of sympathy and not show vexation, which would indicate presumption and misanthropy. Who, on the other hand, laughs readily and is at all times merry, becomes a burden, whence this is particularly to be avoided." In the writing "Upon Decorum" the introduction of philosophy into medicine is recommended: "for the physician who is also a philosopher approaches the divine." In these words, which might easily cause misconception, by "philosophy" is to be understood not so much speculation as ethics in the Socratic sense.

This high ethical view of the medical calling is, with Hippocrates, the incentive to the most laborious study, the most accurate clinical observation, the most conscientious treatment. The good of the patient constitutes the only goal of medical thought and action. "For where love of mankind is, there is also love of art." In this lofty sentence, found in the *Precepts*, the beautiful relationship of ethics to intellectuality finds characteristic expression. Belief in the true art of healing as well as the equally vital recognition of its limitations rest, in the true disciple of Hippocrates, upon considerations of ethics as well as upon those of theory and knowledge. Both are noteworthy in a phase of development in which the very foundations of scientific knowledge and the trust in medical activity were shaken by sophistry and charlatanry.

Concerning medical education "The Law" requires: "natural predisposition, teaching from childhood upwards, love of work, and time." The recognised connection between ethics, professional dignity and practice is shown in the above-mentioned deontological writings by the juxtaposition of ethical precepts with technical therapeutic directions. Thus in the writing "Upon Deportment" we find:—"The physician must, with due regard for dignity, pay attention to everything that concerns palpation, inunction, affusions, the elegant state of his hands, lint, compresses, dressings etc., and, where needful, especial care must be taken of instruments, appliances and other things made of iron. This should all be done quietly and with skill, whilst rendering assistance, hiding as much as possible from the patient. What has to occur should be arranged with quiet and friendly mien; the physician, without self-consciousness, should address the patient, now reproaching him with bitterness and serious aspect, now comforting him with discretion and attention, betraying nothing of what is coming and what threatens him."

The writing "Upon Art" is an apology for medicine, fitting even at the present day, which encounters sophistical adversaries with pointed arguments and opposes unproductive scepticism.

The author says rightly that only so much should be demanded of medicine as is not beyond its limitations. "For if any one assumes that art, or nature when art ceases, ought to be capable of performing a certain act, he is more mad than foolish." The Hippocratic physician deduces from this realisation of the limits of art a conclusion foreign to our ideas,—that help should be withheld from the incurable. Medicine is to him the art "whereby sufferers may be entirely freed from their ailments, and severe attacks of disease mitigated, but which should be refused to those persons who are already overwhelmed by illness, since it is clear that in such cases art can effect nothing."

The second legacy which Hippocrates inherited from the medicine of the Asclepiads and bequeathed to the free physician is closely connected with ethics—viz. tradition. Like all really great physicians Hippocrates was far from shutting his eyes to the history of medical art, far from despising, in blind over-estimation of his own powers, the work of his predecessors, because it may have been faulty. In *Ancient Medicine* he writes: "I do not say that the old art of healing should be abandoned as of no account or as though its investigations were wrongly conducted; on the contrary, I maintain that its way of thinking came so near to truth that one should take it more into consideration and wonder at the discoveries made in spite of so great a lack of knowledge." These words, which even to-day may be laid to heart, demonstrate, not alone the reverent disposition animating the master, but also the motive of that magnanimous action by which Hippocratism restored the discredited art of ancient days to its rightful position.

The principal harm wrought by the speculative spirit in natural philosophy through its arbitrary deductions lay in the fact that the knowledge won through past experience was lightly staked against a preconceived system into which it might not fit. The untutored empiricism of the older physicians, too, was slightly discarded in a consciousness of dialectical

superiority. The thinker who, with deepest insight, coined the imperishable phrase "Life is short, art is long, opportunity is fleeting, experiment fallacious, and judgment difficult"; the physician who knew how to praise him "who only errs slightly" looked upon each individual contribution, however great, as but a link in the chain of evolution. He knew, too, that the seemingly brilliant achievements of one age contain, along with fragments of truth, a sum of error which it is only given to the future to correct.

Hippocrates gathered up the torn threads of the fabric of "ancient" medicine, but by no means identified himself with it; he rescued the groundwork of fact, but embroidered thereon a wholly different pattern.

Dedicated to the highest ideals and yet holding firmly to the real, a new method permeated the material of experience like a ferment—the Hippocratic method. Even though most of the writings, most of the advances are falsely ascribed to Hippocrates himself, the characteristic method of investigation belongs to the great Coan. Herein lies his unassailable claim to be to medicine what Socrates is to philosophy and Thucydides to history.

Hippocrates was the first to raise medicine to independence. This independence could only be founded upon an act of renunciation whereby medical investigation made healing its first and only aim, passing over all that was not closely related to the comprehension of the course of disease and the processes of cure. Just as Socrates, by standing aloof from cosmological speculation and confining himself to ethics, applied philosophy to practical ends, so Hippocrates insisted upon the exclusively practical purpose of all medical thought and action. Medical matters of fact and prognosis were brought into the foreground and pathogenesis only considered in so far as the most transparent ætiological factors were concerned. This made freedom from transcendental influences possible, as represented in priestly medicine, and freedom also from the fantastic ideas of natural philosophy upon the genesis of disease, whereby the healing art was made independent, not only of theurgy, but also of philosophic speculation.

With the recognition of the fallibility of the premises of natural philosophy came the downfall of the method of speculative medicine, which by deduction derived disease from fictitious first causes and explained the efficacy of remedies by the prevalence of elementary qualities, warm or cold, dry or moist.

Hippocrates restored empiricism in place of the deductive process to its former position, declaring it impossible that progress in medicine should be attained in any other way than by that of experience. "The

art of medicine," says the author of *Ancient Medicine*, "has from the earliest ages contained everything in itself, a principle as well as a method, by means of which, in more spacious times, many beautiful discoveries have been made; the rest will yet be found out, if capable investigators, knowing what has already been achieved, commence their research from that point."

Although the name of the great Coan is bound up with the reaction against empty hypotheses and their practical consequences, he was nevertheless far removed from reversion to the crude casual empiricism of a primitive age. This is the more so since his ancestors, the Asclepiads of Cos, linked together their countless isolated experiences with the bond of prognosis and, in a wide-embracing generalisation, were the authors of the "Coan Prognostics." Observation of facts, evidence of the senses were to Hippocrates only the starting-points of a system which not only did not set aside unifying methods of thought, but even imperatively demanded them. The method rendered famous by Hippocrates is one commencing with facts, throughout its course proving its contentions by facts, and striving after laws—the method of induction.

In the first chapter of the *Precepts* the groundwork of the Hippocratic method is categorically laid down. There the *τροβή μετὰ λόγου* takes its place as the foundation of all medical thought and action, that is to say, practice and understanding, evidence of senses and intellectual endeavour.

"The senses which perceive and transmit perceptions to the understanding possess a real faculty of representation. The understanding, however, which frequently receives impressions, observes the whereby, when and how, and stores them as aids to memory. I praise reflection which, arising out of an occurrence, draws its conclusion in methodical manner from occurrences. For, if a reflection takes as its starting-point events which have actually come to pass, it is, as may readily be conceived, under the sway of the understanding. If, on the other hand, reflection arises from no actual events (*i.e.* from sense perceptions) but from a plausible conception, a difficult and unpleasant situation is apt to arise. Hence one should in general hold to facts and not depart from them, so that one may acquire that ready and unerring dexterity known as 'Medical art.'"

Hippocrates, to whom no less a man than Plato makes repeated reference, does not content himself with a general formula for the acquirement of knowledge but gives immediate directions as to the physician's behaviour in particular cases. These directions relate to the criticism, arrangement and compilation of the observations which are to form the basis of judgment. In the book *The Physician's Establishment* the physician is directed, when he comes to the patient, to seek to recognise similarities and dissimilarities (in relation to a condition of health); that is to say, that he shall, by observation of the patient, discover what mani-

festations indicate a deviation from the normal. In this connection he is enjoined to pay attention to the most salient phenomena first.

In addition to this the physician had to submit to examination not only the affected organ, but the condition of the patient's entire body, utilising impressions from all the senses, going into the minutest details. However admirable the observation of such minutiae may have been, the essence of Hippocratism, "the Art," lay in the fact that it knew how, in individual cases, to decide which impressions collectively permitted of conclusions upon prognosis and indicated the occasion for therapeutic measures and the form they should take.

In order to distinguish essentials from accessories in the symptom-complex, the observations were not to be multiplied unmethodically but to be unified, keeping in view the whole no less than the part.

Hence it arose that the authors of the Cnidian Sentences were so severely blamed in the introduction to *Diet in Acute Diseases*, in spite of their observations, since, confused by unessential details, they classified diseases arbitrarily according to fortuitous characteristics, neglected synthesis for analysis and, in their attention to minutiae, failed to obtain a comprehensive outlook on the whole. "It seems to me proper," says the critic, "that the view should embrace the entire art."

Between Cnidian and Hippocratic clinical methods there is the same contrast as may be seen between the historians Herodotus and Thucydides. The former concerns himself more with stories than with history; in his descriptive mosaic there is no complete representation of events, hence no real picture of battles, warlike operations and personalities such as occurs in Thucydides. This brings us to a new essential of Hippocratism which explains a whole series of its peculiarities, both in respect of methods of thought and therapeutics—viz. individualism.

The spirit of the age assigned greater prominence to personality in drama, sculpture and painting; looking gave way to seeing; in place of the older art which only took account of two dimensions was developed a perception of three. As Socrates individualised abstractions, as Thucydides placed personality in the foreground, so does Hippocratic medicine find its starting-point from the physician as exponent of an art, and its goal, not in the micrography of symptoms, not in speculatively conceived schemes of disease, but in the sick individual.

Hippocrates unites the idealistic tendency and the realistic, empiricism and widest generalisation, in a form of individualism, which had nothing but the name in common with the individualistic caprice of the sophist physicians of his day.

Each separate case of illness was to him a natural phenomenon, which was to be studied with all available aids to observation; personal and vicarious experience being brought to bear upon it with due regard to individual peculiarities and to its affinity with nature as a whole.

The Hippocratic physician is enjoined to direct, with unbiassed mind, his therapeutic activity in each particular case according to the special circumstances, keeping the probable issue in view, choosing the right moment for interference, and never allowing local pathological conditions to obscure his survey of the general state.

Not so much sickness as the sick individual, rather cure than scientific pathology, prognosis more than diagnosis, these constitute the foci of his interests. "A definite means of estimation must be sought," says the author of *Ancient Medicine*, "but a means, be it a weight or a number, which shall serve you as a guide you shall not find unless it be your bodily perceptions." Herein he denies the possibility of scientific accuracy in medicine and sees in individualisation the essence of the art of healing. The physician imbued with the Hippocratic spirit is neither formularist nor theorising systematic, but an individualising healer.

This tendency to individualisation in the art explains many apparent contradictions which only seem irreconcilable when divorced from their surroundings and looked at from a different point of view.

One such contradiction lies in the fact that Hippocrates should have brought the utmost sagacity to bear upon investigation without more clearly differentiating existing clinical pictures or adding to them by means of fresh research. He sought the similarities in medicine rather than the differences, in order to make prognosis more sure.

It is thus comprehensible how Hippocrates followed neither purely causal nor purely symptomatic lines in his treatment, but was chiefly led by the principle "*contraria contrariis*," whilst not disdaining that of combating like by like, if the case demanded it. It is also to be understood why he now employed heroic measures, now praised the adoption of expectant treatment, the nature of the case determining the choice of means.

In the light of its practical tendencies the fact is of little significance that Hippocratic medicine, whilst not analysing morbid phenomena beyond a certain point and discarding speculation, was nevertheless pervaded by pathological theories, particularly the humoral doctrine.

To the Coans this theory was not the one, decisive, immutable principle from which therapy could be simply deduced, but was an expression of empirical facts in accordance with the times, an hypothesis of extraordinary

temporary value which, to the uninitiated eye, seemed to be supported by the most widely differing facts in the course of disease. This did not imply the total abolition of other hypotheses.

The same held true for the doctrine of critical days, for that of the inter-relationship between macro- and microcosm, wherein Hippocrates separated the grain of truth from the chaff of superstition. Not every one of his disciples, indeed, followed him in this scientific austerity; many, thinking to outdo him upon one point or another, fell into just those errors from which the master had successfully freed himself. Hence the unequal value of the constituent writings of the Collection, though each one of them reflects, if distortedly, the thoughts of the sage.

The fate, to be understood by only a few of his disciples, is one which Hippocrates shares with all pioneers of thought. There is a seemingly fundamental inconsistency, not in the ideas of the master, but between the individual Hippocratic writings, which consists in the fact that Hippocrates on the one hand restricts medicine to the study of morbid life, to the occupation of healing, whilst on the other he takes into consideration the inter-relationship between the individual and the cosmos. He freed medicine from the purely speculative investigation into nature then prevailing and yet made rational therapeutics dependent upon natural science as a whole. The paralogism is based upon the confusion of deductive natural philosophy with genuine investigation into nature: Hippocrates rejected the former, the latter, according to his view, was built upon the foundation of experience with the framework of induction.

We can thus see how the author of *Ancient Medicine* was in a position to deride the philosophers who, without experience, deduced specialised knowledge from a general conception of nature, yet how the masterpiece "Upon air, water and locality"—reflecting at least the spirit of the Coan—should ascribe an important influence upon medicine to astronomy. It is further comprehensible how in the writing "Upon the nature of man" knowledge of the structure of the human frame is made the basis of medicine, and yet again those are blamed who "in discussion upon the nature of man go further than its relation with medicine demands." For the ideal that Hippocrates constantly saw before him lay at the end of a road running parallel to the conception of the individual as part of the whole, or, as Plato's Phædrus says in reference to the Hippocratic mode of thought, a road which cannot be trodden: *ἀνευ τῆς τοῦ ὅλου φύσεως*.

To Hippocrates, natural science was synonymous with comprehension of human nature under healthy and unhealthy conditions, in its relation to the outer world. The scanty anatomical facts, the speculative physiology

of the nature philosophers, rightly seemed to him an insufficient foundation ; working on strictly practical lines he could dispense with them, for to him nature was abundantly manifested at the bedside, only the power of observation being needed.

As the Greeks, without anatomical knowledge in the present-day sense, were able to formulate their canons by dint of observations in the gymnasia and schools of athletics, so did the professional eye of Hippocrates perceive amidst the confusion of clinical manifestations, despite incomplete realisation of the affinities underlying isolated facts, the unifying law which asserts that morbid symptoms are the expression of a reaction against morbid stimuli. Clinical phenomena, particularly fever, were to him merely reactive manifestations, processes paving the way to cure.

The sum total of the capacity given to separate individuals to accommodate themselves to morbid conditions in proportion to the activity of their vital powers is the *Physis*.

"Natural powers are the healers of disease"—"*Νούσων φύσεις ἰητροί.*" Possibly the realisation of this truth came to the young Asclepiad through comparison of votive inscriptions. Seeing the manifold and frequently absurd nature of the cures, the so-called Asclepian miracles may well have brought home to him the influence of one great common healing factor—Nature. Reminiscent of this is the almost priestly reverence with which Hippocrates approaches the *Physis*, which, to him, took the place of a god of healing ; it also appears that Hippocrates considered himself not as the master, but as the servant of nature. This recognition, however, could only be founded upon a rich store of observation, a wealth of clinical pictures in which the curative power of nature became apparent, without distortion of the point of view by interference. Such pictures are to be found particularly in the first and third books of the *Epidemic Diseases*, writings which could accurately be described as day-books of nature.

The knowledge, born of experience, that nature brings about a cure in many diseases without active interference on the part of the physician, that, in reality, every cure due to art comes to pass only by taking the natural forces intelligently into consideration—a doctrine substantiated in the light of recent medicine—this knowledge led the master, not to de-traction of medical powers, not to scepticism or negation, but to a sharp delimitation of the sphere of medical activity.

Like Socrates, the Coan confutes scepticism by positive, constructive criticism. The *Physis*, in the Hippocratic belief, does not act according to a fixed plan nor in fulfilment of a conscious purpose, even though its manifestations usually promote the restoration of the organism. Like every

natural force it requires regulation, control, guiding in definite directions ; for the preservation of the organism is only too frequently brought into jeopardy by reaction-phenomena, either too violent, too weak, or taking place in unsuitable regions.

It is therefore the rôle of the thoughtful physician to watch the course of events and to interfere at the psychological moment, to check, to divert, or to direct, as the possibility may present itself. In the thrall of contemporary views, Hippocrates by this understood assistance and mitigation of the secretion of pathological juices and a check to their penetration into dangerous localities ; the fundamental principles, however, remain true for all pathological conceptions.

Hippocratic therapy is therefore expectant (awaiting the natural healing processes), with more or less interference according to events in individual cases ; above all does it aim at supporting the powers of the sick individual. The latter purpose is served principally by increase, restriction and judicious choice of food—individualised diet.

Hippocrates, therefore, stands at the confines of two epochs, rooted in the remotest past, yet providing direction and a goal to the immediate present ; a shining example of philanthropy and professional faithfulness ; a seeker after truth with full consciousness of its being unattainable.

The product of an age of intellectual ferment he overcame time, and still exercises upon mankind in its maturity a wonderful, unbroken power by means of his temperate observations, his far-seeing methods and his therapeutic principles, which, derived from nature and opposing no progress, are themselves unsurpassed. He resembles a stream with many springs, vivifying and inexhaustible.

Admired by all, really understood by few, imitated by many, equalled by none, he was the master of medicine for all time.

HIPPOCRATIC MEDICINE IN GENERAL

THE writings of the Hippocratic body undoubtedly all contain something of the guiding spirit of the great Coan, but this does not pervade each one to its depths. Hippocratic medicine as presented in the Collection is therefore by no means synonymous with Hippocratism. The latter remains eternally young, ever true amidst the most advanced scientific developments; the former, on the other hand, contains much that, being the product of its era, has also perished with it. The explanation of this is that disciples, contemporaries and successors of the master sought to bind by rule that which, untrammelled, bore the impress of his professional personality. In this endeavour they sometimes overstepped the fine line dividing certain experience from questionable hypothesis. In this variegated collection, bearing many internal evidences of literary imposture, other schools besides the Coan find expression.

For many centuries indiscriminating criticism ascribed every sentence to Hippocrates himself; thus in the course of history the most diverse and extreme tendencies have, with apparently equal justification, been derived from supposedly Hippocratic teachings. These, although in immediate apposition, are also frequently in irreconcilable opposition—substituting contrary principles for those of temperateness, moderation and self-control.

The manner in which Hippocrates is reflected in the spirit of the age and in which now the deadening influence of formalism, now the deeper conception of Hippocratism predominates, is in itself a gauge of medical progress.

The Hippocratic medical creed resulted from the union of experience with speculative ideas. Clinical observation did indeed throw light upon matters of fact in disease, but not upon the causes of the same, so that in the absence of an anatomico-physiological foundation hypotheses had to be invoked if explanation of disease-origins was not entirely to be abandoned.

Thus in many places, *e.g.* in the introduction to “Prognosis” or in the writing “Concerning Dreams,” a remnant of theurgy may be recognised

in the manner in which the unknown causes of disease are briefly described as divine or supernatural. Such reversions are however unimportant in comparison with the prevailing view, seen particularly in the book "De ære aquis et locis,"¹ or in the writing "De morbo sacro,"² which definitely rejects all medical superstition. Of more importance were the hypotheses of disease of the nature-philosophers. If the nature-philosophers—a term including all investigators of natural phenomena of this period—had discarded superstition their speculative theories would have been accorded the greater following the more they came into line with primeval folk-beliefs and thereby lost the semblance of hypotheses. Hence we find here and there in the Hippocratic writings such causes invoked as abnormalities of the *pneuma* or of the inherent warmth, disproportion of the elements, elementary qualities or body juices, but especially quantitative, qualitative or topical anomalies of the so-called primary fluids (blood, phlegm, bile, water).

The ideas of the leading nature-philosophers with their complex classifications made themselves distinctly felt here and there in the conflict between pneumatists and humoralists, and the entire intellectual movement which sought to reconcile the humoral doctrine with the theory of elementary qualities can easily be recognised in the vivid pages of the Hippocratic body. The question remained undecided; it is even doubtful to which pathological system Hippocrates himself inclined, nor is it of great importance since his medical activity was only to the slightest extent influenced thereby. As a matter of fact, however, the book "De natura hominis" took its place in later times, as the source of inspiration of Coan (Hippocratic) humoral pathology, the theory of the four elementary juices, blood, phlegm, yellow and black bile being dogmatically laid down therein.

Life and the four primary fluids are intimately bound up together, the latter corresponding to the four elements. The blood (originating in the heart) represents the warm-moist quality; yellow bile (secreted in the liver) the warm-dry; black bile (coming from the spleen) the cold-dry; phlegm (formed in the brain) the cold-moist. By means of food a constant supply of material is kept up which renews the cardinal fluids. Health depends upon the equilibrium and upon the normal blending (*εὐκρασία*)

¹ The sexual neurosis of the Scythians, which was considered a divine punishment, is here explained as being due to much riding.

² The following refers to the so-called "sacred disease" (epilepsy):—"It does not appear to me to be of more sacred origin than any other diseases. Men, however, have on account of their inexperience and superstition, believed that there is something divine in its nature as in its cause, because it does not in any way resemble other diseases. If they consider it to be divine because it is wonderful, then there will be many divine ailments and not only one. For my own part I do not believe that the human body is ever befouled by a god."

of the juices, upon the harmony of the inherent forces. Faulty admixture (*δυσκρασία*), disproportionate preponderance and abnormal accumulation of one or other fluid condition disease. Local affections influence the entire organism and produce ailments, even in remote regions of the body, corresponding to the inter-relationships of the organs.

Phlegm coming in abnormal quantity from the head may be the cause of various diseases, according to the part it reaches in its flow : *e.g.* inflammations of the lungs and pleuræ, vertigo, dropsy, sciatica, diarrhœa, dysentery, etc. If phlegm and bile are suppressed, whereby cooling and excretion are hindered, or if they penetrate into the blood, fever results, fever-heat from bile, fever-chill from phlegm. Poverty of the blood or "melting of the flesh" cause suppuration.

The dyscrasia of the fluids determines, according to the Hippocratic view, the nature of diseases ; the immediate cause however is often to be found in unfavourable external influences, faulty habits of life, partly also in morbid inheritance.

The blending of the four principal humours is influenced by external conditions, particularly by the varying seasons. Thus in the spring blood predominates, in summer yellow, in autumn black bile, in winter phlegm is in the ascendancy. The elementary qualities of warm, moist, dry and cold are the connecting links between the juices and the seasons ; as in the latter now one now another quality prevails, so in the organism first one then another humour has the mastery. "In the commencement of the year the phlegm is still the strongest element and the blood begins to wax when the frost breaks and showers begin. The blood increases at this time as a result of the showers and warm days, for this season is most in keeping with it, being at once moist and warm. In summer the blood is still in power and the bile begins to rise in the body ; its ascendancy is maintained till the autumn. In the autumn the blood wanes, for the autumn is in its nature opposed to it. The bile on the contrary dominates the body during the summer and autumn. The phlegm is weaker in the summer than at other times, being in its nature opposed to this season which is warm and dry. In autumn the blood reaches its minimum in the human body, for the autumn is dry and begins to cool down the frame. Black bile, on the other hand, is in autumn present in largest quantity and is then most potent. When winter approaches the bile cools and decreases, whilst the phlegm increases, both on account of the rainfall and of the length of the nights."

This fantastically conceived scheme, comparing the character of the season with the salient feature of the body humour, was only a part of the analogy drawn between cosmic phenomena and organic processes. It possessed, however, empirical support in genuine observations upon the seasonal variations of disease.

"The following observations show that in winter the body is filled with phlegm :—In the winter time men get rid of secretions, by means of spitting and blowing the nose, which consist chiefly of phlegm ; white swellings appear mostly at this time of year as well as other phlegm diseases. In the spring and summer men suffer most from dysentery, blood flows from the nose and they themselves are most heated and red. In the autumn the blood becomes less ; bile governs the body in the summer and autumn. This is proved by the following facts :—Men expectorate bile at this season, and in purgation more bile is passed. In fevers and the coloration of the skin this can be clearly recognised."

As examples are mentioned in the book "*De aere, aquis et locis*, de

humoribus, de diæta ” and in the *Aphorisms*, the influence of climate and season, the weather and place of residence upon the origin of disease.

The significance in ætiology on the one hand of wind, warmth and cold, sunshine and shadow, healthy water and unhealthy exhalations, on the other hand of age, manner of life, food or clothing is discussed, also the duty of the physician in obtaining information from the inhabitants upon endemic conditions; “for amongst a numerous population there are always many who can give information.”

In contrast to the endemic stand the epidemic diseases, which were supposed to be brought about in part by the succession of the seasons, in part by an unwholesome state of the air. (In the latter case the ordinary methods of life were to be continued, but the food was to be less in order to minimise the necessity for breathing.)

It remains characteristic of Hippocratic medicine—in contrast with oriental—that recognition of the dependence of the sound or diseased organism upon the great cosmic agencies did not lead to neglect of the independence and personality of the individual. “One should know to what disease nature most inclines. . . . As regards the relationship of natures to seasons, these are well or badly disposed towards the summer or winter, others well or badly disposed towards countries, ages, habits of life and conditions of disease.”

In the observation of the course of disease, the Hippocratists’ attention was attracted by acute, feverish illness, in which the alternations of temperature, the excretions varying in amount and consistency and the periodicity of phenomena all indicated adherence to law, whereby conclusions upon the development, severity and result of the complaint were justified. Chronic affections were to them only sequelæ of acute.

According to current physiological conceptions the clinical picture of disease as, for instance, of pneumonia, always gave rise anew to the impression that the “Physis” was waging a stormy and varying conflict whose object was the expulsion of the *materia peccans* and that the phases of the contest between disease and the healing power of nature were reflected in the condition of the fluid secretions which, under the influence of the “inherent” warmth (fever-heat), underwent a series of changes.

The simplest example, frequently quoted by the Hippocratists, was that of coryza, where the local irritation and fever were eliminated by the mucous secretion, which in the first place was watery and acrid, improved only setting in when the flow became “thicker, less acrid, as though boiled and mixed with the earlier secretion.”

The generalisation arrived at was that the materials of disease, in order

to be eliminated, had everywhere to undergo an alteration in consistence by "mixing and coction." Every disease, now clearly, now obscurely, passed through three stages; that of ἀπεψία, the uncooked, raw state, acidity; that of πέψις, coction or ripening; that of κρίσις, solution or elimination, wherewith is bound up the result (cure or death). The illness presents a different picture according to its stage and this picture is an indication of the course the illness is to run. The crisis may be a local or a general one, it may take place rapidly through increased secretion or excretion, or deposition (ἀπόσπασις) of the disease-products (in the parenchyma of distant organs). The same result may also be brought about in the form of lysis—when the coction occurs gradually—or by the transition of one form of fever into another.

Accumulated experience led to recognition of the fact that in some febrile affections the crisis occurred with a certain regularity, so long as the typical course of the disease remained undisturbed by remedial measures. Through precipitate striving after exact data this experience resulted only too readily in adherence to the primeval belief in mystical numbers, a belief which made its appearance upon Greek soil in the garb of Pythagorean philosophy. Thus arose the doctrine of critical days, which early led to fantastic jugglery wherein the numbers four and seven and their multiples played an important part. Wherever, in the Hippocratic writings, the temperate discernment of their intellectual originator makes itself felt, whilst the cyclic course of febrile disease is recognised as a principle, warning is given against predicting the crisis by means of calculations founded upon entire days.

The crisis in fevers with exacerbation occurring on even days was supposed to be upon the 4th, 6th, 8th, 10th, 14th, 20th, 24th, 30th, 40th, 60th, 80th, and 120th day; where the exacerbation occurred on odd days the crisis was to be looked for on the 3rd, 5th, 7th, 9th, 11th, 17th, 21st, 27th, or 31st day. Deviation from these days signified relapse or death.

In the 37th chapter of the book upon Prognosis is the statement that on the 4th day mild fevers come to a crisis but malignant ones lead to death, "That is the end of the first period, the second however extends to the 7th day, the third to the 11th, the fourth to the 14th, the fifth to the 17th, the sixth to the 20th. These diseases therefore being mostly acute, come to an end, increasing by four days at a time up to twenty."

Aphorism II. 24 says:—(the course of a fever) "of seven days may be known upon the 4th day; the next week has its starting-point on the 8th day, but particular attention should be paid to the 11th day, as it is the 4th of the other week, and again to the 17th day as it is the 4th reckoned from the 14th and the 7th from the 11th. The critical fall of a fever was of good augury upon the 3rd, 5th, 7th, 9th, 11th, 14th, 17th, 21st, 27th, 31st, and 34th days.

The writing upon the "critical days" gives as decisive days in fever the 4th, 7th, 11th, 14th, 17th, 21st, 30th, 40th, and 60th. In the book "De carne" as in "De sept. partu" this juggling with figures has been reduced to a system. In the first it is written: "Acute

diseases are decided after a lapse of four days, *i.e.* in half a week ; secondly in one week ; thirdly in eleven days, *i.e.* in one and a half weeks ; fourthly in two weeks and fifthly in twenty days less two days, *i.e.* two and a half weeks."

According to the latter writing, the physician must beware of all odd days, but also of the 14th, 28th, and 42nd days. "For this is the limit which many place upon the doctrine of harmony and the even and complete number."

The observation of crises forms one of the pillars upon which the prediction of the result of disease rests.

Prognosis gives to the mental attitude of the Hippocratist its characteristic colouring and leaves diagnosis far behind it in importance. This relationship—reversed in the medicine of to-day—resulted from the stage of development of current examination methods and is an expression of the wholly practical endeavour of the Hippocratic art.

For it is the fate of the patient, not so much the recognition of the nature of disease, that the physician has to consider ; whilst in fact the critical consideration of clinical observations, even if without deeper insight into their relevance, may often provide means of gauging the severity of the probable outcome of an ailment and may furnish a clue for its treatment.

The imperfections of the accessory sciences and the state of contemporary examination technique made it far more often possible to the seeing and perceiving physician, by association of the greatest possible number of observations upon a particular case and by comparison with similar groups of symptoms, to acquire a general impression of the course of the disease, and thus the establishment of a prognosis, than to attain to any real diagnosis. The restricted aim of the medical profession brings it about that the path of the Hippocratic physician—trodden also to-day where anatomical knowledge is lacking—is long, uncertain, and makes great demands upon the talents of the individual. He also, however, can reach the same goal as is attained by modern anatomico-physiological diagnosis with economy of individual effort in a shorter time and with far greater certainty. This consideration explains why so few were able to become physicians in the Hippocratic sense, not in word only, but in deed, and how power of observation had to expend itself upon minute details, with the consideration of which we can now dispense, just as observation of the stars was of far greater importance to the sailor before the discovery of the compass than it is to-day.

Prognosis occupies a large space in the Hippocratic writings, several of the most important works being exclusively devoted to it. "It seems to me best," says the author of the *Prognosticum*, "that the physician should acquire practice in the anticipation of the outcome of disease, for if he is able to recognise in his patients and predict the status *præsens*, the past and the outcome, as well as that which the patients omit from their accounts of themselves, then he will inspire great faith and, being thought to know the state of the patient better, the physician will be treated with greater confidence. The treatment will also be better carried out if the ultimate result of the disease is foreseen."

The method of arriving at a prognosis is an inductive one, taking its starting-point from the clinical history, the importance of which is to be estimated by former individual experience and external evidence, taking into consideration the age, sex, habits of life and residence of the patient, the climatic and epidemic conditions.

Of clinical histories—the first in the modern sense—there are admirable examples in

the *Corpus Hippocraticum*, particularly in the "Epidemics." In book iii. chap. 16 it says: "I hold it to be an important part of medical art to be able to make a correct judgment of what is written, for he who can and does do this appears to me, in matters of his art, unlikely to make any serious error."

Eyes and ears, and indeed every means, sensory and intellectual, were employed in order to arrive at an opinion based upon experience as to the general condition of the patient. Without neglecting subjective symptomatology, the objective examination from head to foot was undertaken with the care and thoroughness which constitute so salient a feature of Hippocratism. This painfully minute observation and examination served, however, the additional purpose of explaining, by the combined action upon a particular case of external influences and individual peculiarities, those details in the course of an illness which might diverge from the disease-type. Hence the clinical history, as such, constitutes one of the most noteworthy characteristics of Hippocratic, in contrast with the rigid scheme of oriental medicine; the clinical history takes individuality into account.

It were matter for wonder if the wealth of clinical observations, many of them of first importance, had not given rise to diagnostic conclusions in the modern sense. It is beyond doubt, however, that the moving cause was not a pure scientific endeavour to foster and develop diagnosis, but that this was viewed, where circumstances permitted, as a subordinate procedure, a short cut by which to arrive at a prognosis, a means of obtaining guiding principles for treatment.

Whilst diagnosis and prognosis were not in principle distinguished from one another, the Hippocratic writings contain general directions upon methods of examination and a most copious symptomatology. External localised affections were most minutely examined by sight and touch from the point of view of position, size, shape, consistence, painfulness, temperature, colour etc., whilst in internal (invisible) maladies a number of methods both sensory and intellectual were employed. The following had to be noticed:—age, temperament, mental state (memory, delirium, picking at the bed-clothes), facial expression, tongue, voice, attitude in standing or in bed, condition as to nourishment or strength, power of movement, sensibility to pain, behaviour during sleep, sensation of hunger or thirst, temperature, abnormal pulsations, breathing, exhalations, condition of skin, hair and nails, state of the sense-organs, particularly of the eyes, possible abnormalities of the hypochondrium (enlargement of liver or spleen), abdominal swellings, possible tumours or abscesses, amount, colour, consistence, smell, taste of blood and excretions, exceptional

symptoms, such as gnashing the teeth, yawning, hiccough, sneezing, epistaxis, flatulence, itching, shivering, twitching etc.

A noteworthy sign was held to be that change in the features known even to-day as the "Facies Hippocratica." Pointed nose, hollow eyes, sunken cheeks, the ears cold, shrunken and standing away from the head, a hard, strained and dry forehead, a yellow, dusky, livid or blue colour of the whole face. It was well known, however, that these manifestations took place not only in the dying, but transitorily also as a result of conditions producing exhaustion (hunger, sleeplessness, diarrhoea etc.).

The supine position, long maintained, especially if with extended extremities and open mouth, also the prone position, if contrary to habit, were considered of bad augury.

Dealing with external appearance and build, the characteristics of the consumptive are indicated: a body with little hair, a feminine skin, a complexion the colour of a lentil, yellow eyes, a skin as in anasarca, prominent shoulder-blades. A favourable sign is that the consumptive patient should not be wasted and should possess a chest with a plentiful growth of hair.

Temperature was estimated by the hand laid upon the breast. As to the pulse, the Hippocratists did not practise the methodical counting and detailed examination upon which later so much stress was laid, but they did not fail by observation and touch to draw prognostic conclusions from abnormally strong pulsation. Numerous references prove that pulsation in the temples, in the cardiac region, in the abdomen, in the arm and at the wrist joint were both observed and palpated.

Greater prognostic value was ascribed to the manifestations in which the eyes played a part, such as position and movement of the eyeball (strabismus, protrusion), colour of the lids; the unequal size of the pupils in brain-disease was also known.

The greatest attention was directed towards the nature of the secretions and excretions, the examination being made not with the eye only, but also by taste and smell.

The odour of the sweat, of the sputum, of the vomit, the urine, the fæces, of discharge from wounds; the taste of skin secretions, of wax from the ear, of nasal mucus, of the tears and sputum (sweet or the contrary) and of diverse other body fluids had to be investigated, partly by the physician, partly by the patient himself. "The nose gives, in fever patients, many excellent hints, for the odours are very varied." The cold, warm, or sticky nature of the sweat, its occurrence upon critical or non-critical days, the varieties of sputum—according to quantity, colour, etc.—of vomit, urine and fæces constituted important factors in determination of prognosis.

A few instances from an overstocked semeiosis may be given here. The sputum must be easily got rid of and the yellow part intimately mixed with it . . . entirely yellow and slimy sputum is unhealthy. If it is so little mixed as to appear black that is of still worse portent. Yellow sputum, mixed with a little blood, occurring at the beginning of the illness in a patient suffering from inflammation of the lungs is a sign that he will recover, and is beneficial, occurring for the first time about the seventh day it is a somewhat surer sign. Vomiting is in the highest degree beneficial, when phlegm and bile are intimately mixed. If the vomit be as green as a leek, colourless or black it must be held as of bad import.

If, however, the patient vomit all these colours it will be most dangerous for him.

The healthiest stool is soft and of even consistency. . . . The stool should be thick at the critical period of the disease. Watery, white, yellow, wholly red or frothy evacuations are always bad.

The urine is at its best when the sediment is whitish without any solid masses and even in quantity throughout up to the crisis.

When the urine is cloudy when passed, if the clouds be whitish it augurs well, if black,

badly. Evil-smelling, watery, black and thick urine is unhealthy. In grown-up people black urine is the most dangerous, in children watery. One must not be misled in cases where the bladder itself is diseased and gives such characteristics to the urine, for then the symptoms are not those of the body as a whole, but only special ones pertaining to the bladder.

It is an interesting fact that aids to examination were sought for: In the Aphorisms v. 11 it is stated: "In consumptives it indicates death when the excretions remain offensive after being shaken with charcoal." Epid. vii. 25. "The urine adhered to a straw and was viscous and like semen."

Similar aids, too, were purgatives given experimentally; observation of the patient after vigorous walking or running.

In addition to inspection, for which frequent observation of naked men in the gymnasia served as the best education, palpation was developed to such an astonishing degree that the Hippocratists were able, by this means alone, to satisfy themselves as to the position, size and consistence of the liver, spleen and uterus (in the last case vaginal exploration by the midwife was added). There is no evidence as to whether they made use of percussion in the diagnosis of ascites and meteorism; auscultation, on the other hand, played an important part in the investigation of chest affections.

It appears as though a therapeutic method, founded upon false premises, paved the way to auscultation of the lungs, viz. succussion, or shaking the thorax with the hands on the patient's shoulders. This shaking (*παράσισμα*) was supposed to effect the outflow of pus from the parenchyma of the lung by way of the bronchi.

Recognition during this process of the splashing sound which occasionally occurred (in pyo- and hydropneumothorax, but also in bronchiectasis and cavities) resulted in the employment of succussion (known now as Hippocratic succussion) as a diagnostic method in order to determine whether and where pus were situated in the pleural cavity, also the most suitable spot for incision in thoracocentesis.

De morb. ii. 47 mentions succussion as a therapeutic method in empyema. If it, as well as the pouring of fluid into the throat to excite coughing and expulsion of the pus, fail, then the operation of thoracocentesis is called for. "Such a patient is given a large bath of warm water, he is seated on a firm stool, whilst an assistant holds his hands, the operator, however, shakes him by the shoulders and listens to determine upon which side the noise may be heard. This spot—preferably on the left side—is chosen for the incision. According to Praenot. Coac. 424 empyema patients in whom a loud noise is heard have less pus than those in whom dyspnoea accompanies a slight noise. Full of pus and in danger of their lives are those who exhibit a high degree of cyanosis and dyspnoea, but in whom no noise can be elicited.

In addition to the splashing succussion sound the Hippocratists were familiar with other sound manifestations: tracheal rattling, crepitations, and pleuritic frictions.

It is a dangerous phenomenon "when inside the lung pale yellow masses are present which cause expectoration to cease. By the following sign one may know if they are present in the lung or not; if present a noise will be heard in the windpipe on breathing."

Of the diagnosis of "Hydrops of the lung" it is stated: "When the ear is held to the side and one listens for some time, it may be heard to seethe inside like vinegar." A pleuritic friction is well described, *De morbo ii.* 59. "A grinding may be heard which sounds as if it came from two leather straps."

Of all the diagnostic methods employed by the Hippocratic school the commencement of physical diagnosis was the one which received least recognition, and it lay fallow to be more fully developed only after the lapse of centuries. It is an historical fact that the founder of modern auscultation was in part stimulated by the Hippocratic descriptions, whereby dormant seeds of thought from ancient times developed and grew to an undreamt-of height.

Hippocratic treatment is guided by clear insight into the fact that cure can only be achieved within the bounds of the physis and by means of its power, that it is the physician's task so to direct the natural processes of reaction which are mostly, if not solely, purposeful, that the preservation of the organism be his goal. In full consciousness of the aim, of the limitations and of the potentialities of his art the Hippocratic physician occupied himself only with those diseases in which a cure might be anticipated and approached the sick-bed inspired by the principle: "Do good, or at least do no harm."

Fixing his attention upon the course of events and anticipating their turn, keeping in view individual peculiarities and their relation to the whole, he only interfered actively at the right moment, when the flagging resiliency of the organism, when excessive or unsuitable reaction endangered a happy issue. "Do nothing without a purpose, overlook nothing."

According to Hippocratic views, the one imperative indication is to maintain or replace the necessary measure of bodily energy. It follows therefore that the ordering of the habits of life, the regulation of the food-intake and its relation to the conservation of strength, dietetic therapy in its widest sense, constitutes the foundation of treatment.

From diet, to which the earlier physicians gave so little thought, the author of *Ancient Medicine* derived the whole arts of healing.

In acute affections, particularly at their height, partial withholding of food was held to be indicated; in fevers and cases of wounding, fluid nourishment. An important rôle was played by *πτισάνη*, a decoction of barley. According to individual conditions and the stage of the illness, a definite quantity, first of the thin filtered portion, then of the unstrained broth was administered. Honey-water, sour honey (vinegar, honey and water, *ὀξομέλι*), milk and various wines were employed as drinks. Besides the "ptisane" other invalid broths were employed made from millet, meal and wheat. The book *De Diæta ii.* treats with

admirable thoroughness of the individual articles of food according to their efficacy. In chronic affections the Hippocratists not only regulated the diet but borrowed from the experience of the gymnasts and ordered, though not arbitrarily, walks, exercises, bodily work (*e.g.* sawing wood), baths, massage, reading aloud, singing, etc. Adiposity was treated by daily increased walks with reduction of the amount of food, followed by increase in the food and gradually diminished exercise.

An important rule laid down that in ordering the method of life care be taken to avoid all excess (hunger-cure, the exhausting runs of the gymnasts etc.) and not to change previous habits too suddenly; "for all excess is inimical to nature, whilst all that is gradual is without danger, particularly when it is transition from one thing to another."

It was particularly in febrile diseases that the purpose was exemplified of assisting natural processes by restricted diet and fluid nourishment. The Hippocratists strove, on the one hand, not to exhaust the natural forces through the exercise of digestive activity, nor to interfere too much with them in their endeavour to effect a cure. "The more an unhealthy body is nourished, the more harm is done to it." On the other hand it was sought, by means of cooling demulcent drinks, to facilitate the elimination of the morbid humours. At the height of the fever, before the crisis, light diet was deemed imperative. Drug treatment was carried out by preference upon the principle of assisting the elimination of morbid materials, which was now increased, now moderated, or such materials were diverted from unfavourable regions. In the stage of "crudity of the humours" whilst the fever had not yet betrayed its nature, the Hippocratists took no action, but only in the stage of "coction," which interference was indicated by certain manifestations. "Cooked" matter is to be diverted and caused to flow, but not "uncooked," and not at the beginning, unless it strive to force its way out.

"Matter in process of being separated or newly separated must not be strongly acted upon, nor encouraged to fresh activity, whether by drugs or by other stimulants, but must be left alone."

Means of assisting incomplete elimination were mild purgatives, emetics and blood-letting, also diuretics, but not pure diaphoretics. The paths chosen by the humours themselves were as a rule those to be aimed at by medical endeavours, that is to say, excretion was to be assisted on its own lines: "What has to be got rid of should be derived according to its own tendency, by the appointed ways."

If the humours have an inclination to go where it is inadvisable they should, *e.g.* phlegm to the lungs, they should then be led aside or their stream diverted, those which tend upwards being drawn downwards and *vice versa*.

The choice of purgatives and emetics, mostly mild in action, proves

that the Hippocratists practised diversion of the injurious humours rather than drastic elimination, which they even considered contra-indicated. Blood-letting was the principal means employed to this end, particularly in violent inflammations, and if relatively seldom employed it was in urgent cases energetically practised. The venesection was carried out mostly on the arm, foot, popliteal space, tongue, etc., and pushed as far as possible, even to the production of faintness, for, "in the treatment of advanced disease extreme remedies, employed with care, are the best." Similar but far less efficacy was ascribed to cupping or scarification; the use of leeches was not yet known. Blood-letting and cauterisation were intended for the relief of pain as well as for the derivation of the humours.

As is shown by the treatment of pain, the lines of thought of the Hippocratists were directed towards the removal of the causes of disease, not only towards the relief of symptoms, they at least realised the *indicatio morbi* as it was known in later terminology. Hence it was regarded as an error if a physician administered to a patient too great a quantity of nourishment under the impression that his sickness arose from emptiness of the vessels, or, on the contrary, reduced a patient by means of a restricted diet, when emptiness of the vessels was really the cause of his complaint.

Even if the actual therapeutics of the Hippocratists seem to us symptomatic, in the light of modern conceptions of disease, their method of thought, judged by the standard of contemporary pathology, was in reality *ætiological*.

It did not by any means escape their consideration that purely fortuitous and unessential effects of remedies sometimes bring about successful issues; that the same drugs in different patients, or administered to the same patients at different times, may have dissimilar or even opposite effects; that substances with apparently conflicting properties may bring about identical results.

These observations led to the conclusion that disease only comes to an end through removal of its cause, which removal may sometimes come to pass by means of remedies which produce (in healthy persons) symptoms resembling the disease-phenomena which have recently ceased.

Hence the Hippocratists were far from establishing the principle which later was enunciated, of "*Contraria contrariis*," because, as is stated in "*De prisca medicina*," the action of a remedy cannot be deduced *a priori* from a primary quality (warm, cold, dry or moist), but experience, on the contrary, is necessary in order to arrive at a conclusion.

SPECIALISED MEDICAL KNOWLEDGE IN THE CORPUS HIPPOCRATICUM

THE anatomical knowledge of the Hippocratists was derived chiefly from dismemberment of animals, experience in slaughtering and sacrifices, and from the observation of surgical cases. Systematic dissection of the human body was out of the question owing to the religious precepts which strictly enjoined immediate burial, and to the superstitious horror of the dead which then prevailed. The supposition that outstanding individual investigators, upon rare occasions, did not hesitate to examine human bodies or parts of bodies (particularly bones), in order to correct prevailing opinions, is one which, if not susceptible of direct proof, is at least probable. This supposition, besides being borne out by many statements on the part of ancient writers, is the more probable since the bodies of savages, traitors and criminals were outside the pale of religious ordinances and were therefore available, as were also accidentally obtained portions of the body, to satisfy the curiosity of scientific investigators. No one of the oft-quoted extracts from the Hippocratic writings, supposed by individual historians to refer to human dissection, is quite conclusive, whilst nowhere is there in the pathology of the day any definite trace of anatomical research upon the bodies of those dead of disease. On the other hand comparisons are frequently instituted by the Hippocratists referring to facts acquired through zootomy or to anatomico-pathological discoveries such as might have been made in the slaughtering of beasts.

Anatomical teaching, upon which, according to Galen, the Asclepiads laid such stress, was based upon oral demonstration and frequent dissection of animals; possibly also models of skeletons were used similar to one which was preserved at Delphi as a reputed votive offering from Hippocrates.

The false analogies drawn between the results of zootomical investigation and human anatomy explain the many deficiencies in Hippocratic knowledge, *e.g.* the doctrine of a two-horned uterus, from which arose a whole series of fantastic hypotheses.

Osteology is thoroughly dealt with in the Hippocratic writings; there are excellent

descriptions of bones and individual joints (*e.g.* of the ribs with the vertebræ and sternum, of the hip-joint, but the knowledge shown of the knee and elbow-joints is faulty); diaphyses and epiphyses were known, the periosteum, the marrow, the sutures of the skull, the diploë, the inner and outer tables; the existence of synovia was also known. The muscles were not clearly distinguished from the soft parts. The significance of tendons was not well understood, they were confused with nerves and ligaments. The muscles known seem to have been the temporal, masticatory, muscles of the back of the neck, deltoid, pectoralis major, biceps, triceps, brachialis, flexors of hand and fingers, psoas, gluteus, biceps femoris, tendo Achillis, muscles of the back.

Knowledge of the viscera was scanty. Mention is made, but no exact description given, of the mouth, gullet, œsophagus, stomach, intestines, liver, with transverse fissure and gall-bladder, spleen (resembling the sole of the foot), mesentery, meso-colon, peritoneum, kidneys (heart-shaped), bladder, testes, vesiculæ seminales, ejaculatory duct, uterus (two-horned), uterine ligaments (ovaries were not described), external and internal os uteri (the vagina was reckoned part of the uterus, the hymen was unknown).

With regard to the respiratory tract, the Hippocratists knew the trachea, epiglottis and bronchi, and described the lungs as having five lobes. Amongst glands the tonsils, cervical glands, axillary, inguinal and mesenteric glands and those of the breast were known.

The circulatory system is described in the various writings in a most confused manner. The starting-point was at first supposed to be the head, later the aorta and vena cava, which were thought to spring from the spleen and liver; according to the book *De morbo sacro*, all arteries enter the heart.

The word *φλέβες* signified originally all the hollow organs of the body, later the arteries. *ἀρτηρίη* in the first instance meant the trachea and bronchi; later the arteries, principally or exclusively containing air.

The best known were the large and superficial ones, but their ramifications are for the most part very fantastically represented. In the description of the heart mention is made of the pericardium, the auricles, the septum, the ventricles, the semi-lunar valves and the chordæ tendiniæ. Both ventricles communicate, the left being nourished from the best portions of the blood of the right.

Neurology is in a very rudimentary condition, nerves being confused with tendons, ligaments and vessels, the brain being regarded as a gland filled with a cold fluid.

It is surrounded by a thicker and a thinner integument and divided into two halves; from it springs the spinal cord, which is similarly enveloped.

The nerves mentioned are: the olfactory, optic, trigeminus, vagus, sympathetic, brachial plexus, ulnar, sciatic, intercostals etc.

Any intimate knowledge of the organs of sense is lacking. The eye is described as having three coverings, the white one, a thinner one, and one resembling a spider's web. The outer one (white) contains the cornea (*τό διαφανές*, transparent), lying in front of the pupil, the middle one (thinner) the iris (*τό μέλαν*).

Of the ear the Hippocratists knew the bony part and the drum.

Hippocratic physiology is wanting in strict coherence as a result of the heterogeneous origin of the individual writings and can only be collated from scattered statements which not infrequently contradict one another. The influence of the nature-philosophers upon fundamental principles is clearly displayed in the conception of the vital principle and of the constituent elements of the body, whilst the Hippocratic writings clearly show how mutable and wearisome was the conflict of opinions over these

questions in the camp of the speculatists. We find writings the theory of which takes one or other of the four elements as its starting-point, air or fire, or fire and water; others in which antagonism of the qualities of warm, cold, dry and moist, of sharp, sweet and sour plays the chief part; finally those in which the origin of all phenomena is traced to the body humours, which were looked upon as representing the cosmic elements and their qualities or as particular modifications of these. At one time two humours, phlegm and bile, represent the antithesis of cold and warm, at another there are four cardinal fluids to correspond with the four elements or four qualities: blood, phlegm, water and bile; or blood, phlegm, yellow and black bile. In this last form, as it appears in the writing "*De natura hominis*," the four-humoral theory is at last definitely enunciated.

The ancient controversy, too, as to whether the air or the warmth represented the actual vital principle finds a solution which is in effect a compromise. The warmth is raised to the position of actual vital principle, but (considered as an abstraction apart from the blood) is made dependent upon the supply of *pneuma*.

The two main ideas permeating Hippocratic physiology are: the idea of design—"Nature suffices for everything under all conditions" (*De alimento* xi.)—and the conception that all organs co-operate in their functions, being united to form an harmonious whole, "A mutual attraction, a union, a sympathy" (*De alimento* xxiii.). Every disturbance therefore affects the whole system.

It is of interest as illustrating the Hippocratic methods that they frequently exemplified physiological processes by materials and forces of daily life. The next step is marked by parallels drawn between macro- and microcosm, between animal and plant life, or, notably in the Cnidian writings, by physical comparisons. Clinical experience and experiments were included as means of acquiring knowledge. Thus the author of "*De musculis*" points to the fact that in the case of suicides section of the windpipe produces loss of voice, from which it is deduced that voice is caused by resonance of the air inside the windpipe. The writing "*De corde*" contains the statement that, in the act of drinking, a portion of the fluid passes into the windpipe, in proof of which the following experiment is adduced: "If water coloured with ochre or vermilion be administered to an animal almost dying of thirst, preferably a pig and, whilst it is still drinking, its throat be cut, the windpipe will be found coloured with the fluid." In the same writing it is stated that proof can be made of the competence of the semi-lunar valves, for: "If a heart

be taken out of the body and, of the two valves, one be supported and the other be allowed to hang free from the walls, neither water nor air impinging upon them will be able to effect an entrance into the heart."

The fundamental principle of life is the "inherent" warmth of the body (*ἐμφυτὸν θερμόν*), which has its seat in the left heart. Under the influence of this inherent warmth elementary fluids of the body are formed from food, and from variable admixture of these fluids solid parts of the body are formed. The diversity of the organs is explained by different degrees of influence exercised by the warmth upon the primary matter. Blood is the chief material from which organs are built up; it is produced in the liver and obtains the necessary temperature in the left ventricle. From thence, propelled by the pulsating heart, it circulates by means of the "veins" throughout the entire body. There is no exact account of the content of the left ventricle and arteries, it is only certain that this was supposed to be, either the *pneuma* alone or principally *pneuma*, with only the smallest particles of blood. The facts that, in cases of injury to arteries, a hissing sound could be heard and that, in the cadaver, the left ventricle was always found empty, seemed to constitute a definite "proof" of these fallacious views.

Upon the functions of the lungs and respiration there are only indefinite and contradictory accounts. According to "De anatome" the lungs, cold in themselves, take up the cool air in order to reduce the temperature of the heart. This "cooling" is also assisted by the fact that, in drinking, a small portion of the fluid penetrates into the pericardium by way of the windpipe. (Due to presence of fluid in the pericardium after death.) On the other hand the warmth inherent in the heart was supposed constantly to be maintained by the air, which streams out of the lungs and their vessels, that is to say, by the *pneuma*.

In complete ignorance of the significance of the nervous system the Hippocratists looked upon the *pneuma* as source of sensation and movement. Opinions varied as to the central seat of this. According to "De morbo" the *pneuma* spreads itself throughout the whole body from the brain; according to "De corde," on the contrary, the heart constitutes the starting-place of the pneumatic circulation. This is in accordance with the fact that, in the first-named writing the brain is held to be the seat of thought, sensation and will, whilst the author of "De corde" places the seat of understanding in the left heart. The brain is, for the most part, looked upon only as a gland, as the seat of cold and phlegm, entrusted with the task of attracting to itself the superfluous water of the body. (If, in these functions, a disturbance sets in, abnormal accumulations of phlegm occur in other organs, *i.e.* catarrh.) In addition, it serves as the spot in which the semen—derived from the whole body—is collected, from whence it descends to the testicles.

As regards sense impressions, vision is explained by perception of the image mirrored in the pupil; hearing by echo from the hard skull bones and conduction to the brain; smell was said to occur by penetration of olfactory particles to the brain through the plate of the ethmoid.

The embryology of the Hippocratic body rests upon observations made on the bodies of prematurely born infants or on hens' eggs partly hatched. It was supposed that all parts of the child are distinctly visible by the thirtieth or fortieth day at the latest, whilst the human form is clearly to be made out by the seventh day. The foetus is nourished by means of the umbilical vessels, but also sucks the cup-shaped elevations upon the inner uterine wall which carry air to it. Concerning generation, the Hippocratists believed the semen not to be a product of the testicles, but to be collected from the entire body. The uterus is bi-cornuate; before the onset of menstruation the os uteri is raised, before delivery it is depressed; in *primiparae* the thigh-bones during labour are pushed apart.

Knowledge of the drug-lore of the Hippocratists comes mostly through

Cnidian writings, particularly those upon gynæcology. In all three hundred drugs are enumerated.

It is indicative of the connection between Greek and foreign medicine that so many drugs are of Indian or Egyptian origin. The form of the Cnidian prescription is also of Egyptian origin and literal coincidences with the Brugsch and Ebers papyri are found. Trade between Egypt and Phœnicia on the one hand and India on the other, led to the introduction into Greek medicine of sesame orientale, cardamoms, andropogon, laurus cinnamomum, amomum, etc.

The Hippocratic Collection lacks any complete or ordered classification of the varieties of disease. According to their distribution they were distinguished as epidemic, endemic and sporadic; according to their course as acute and chronic. In the book "De victu in acutis" is the statement: ". . . acute diseases are those which the ancients called pleuritis, peripneumonia, phrenitis, lethargy, and other diseases included in these and in which the fever is mostly a continuous one." This quotation shows that the terminology in use in the time of Hippocrates, and of which so much survives in the technical language of modern medicine, if indeed with an altered meaning, was even then of great antiquity. In the Cnidian writing "De locis in homine" seven varieties of catarrh are enumerated: of nose, ears, eyes, lungs, spinal cord, spinal column and hips.

The various types of disease recognised in Hippocratic pathology cannot always be incontestably identified with the types differentiated by modern ætiological and anatomical methods, for the ancients were naturally influenced in their classification only by the most salient symptoms, whereby many heterogeneous diseases were thrown together.

This held true in particular of fevers, which were no doubt as a rule forms of sub-tropical malaria but occasionally also of typhoid fever and influenza. Distinguished were: ἀμφημερινὸς πυρετός=quotidian fever; τριταῖος π.=tertian; τεταρταῖος π.=quartan; ἡμιτριταῖος π.=semi-tertian; tertian and quartan are caused by phlegm and bile.

καῦσος=burning fever is defined as "fever with internal heat and external cold." λήθαργος is a fever with somnolence; λειπυρία is fever with nausea and vomiting. Phrenitis may be any feverish illness in which intellectual disturbance (delirium) is the leading symptom. A notable observation is that of epidemic parotitis with tendency to metastasis to the testicles.

Diseases of the oral cavity mentioned in the Hippocratic Collection are: noma, scurvy, aphthæ, tonsillitis; diseases of the intestinal tract; diarrhœa (with anuria), lientery, tenesmus (described as a separate disease), dysentery (ulcers of the intestine caused by scraping; treatment: emetics, sternutatories, diet and hot douches to the abdomen), ileus (cause, indurated fecal masses; treatment, insufflations of air per anum). Symptoms frequently mentioned are: swellings of the spleen and liver with consequent icterus, dropsy, marasmus and epistaxis. Collections of pus in the abdominal cavity are recognised by the application of wet clay, which over the affected part dries rapidly. Diseases of the respiratory tract, particularly of the lungs, are exhaustively described. Laryngitis, κυνάγχη (angina) is any obstruction in the larynx.

Inflammation of the lungs and *πλευρίτις* are often classed together, according to "De locis in homine." The disease, confined to one side, signifies pleuritis, if on both sides, pneumonia. As originating causes rank phlegm flowing downwards from the head, which causes irritation and may lead to empyema; also accumulation of blood or salt phlegm, the coagulation of which may cause tumours, *φύματα*. The frothy sputum of pulmonary oedema is compared to spiders' webs. Pleurisy, according to Cnidian teaching, also arises from pneumonia, the swollen lung coming into contact with the costal pleura and setting up inflammation in it; "dry" pleurisy is described as a special variety, caused by excessive thirst. Empyema is, in the widest sense, the name applied to any collection of pus; in the narrower sense, a collection in the lung or pleura. The treatment of pneumonia and pleurisy consisted in warm lotions, poultices, inunctions with oil, warm baths and diet; in the writing "De victu in acutis," the use of infusions and their correct dosage, is laid stress upon. Active measures were not undertaken before the seventh day; amongst these were, in order to get rid of the mucus, sternutatories, expectorants (fat and salt articles of food, sour wine etc.), injection of fluid into the windpipe (in order to provoke cough); in the case of empyema, cauterising the back, thoracocentesis. In addition to the above-mentioned affections, are enumerated, hæmoptysis, hydrothorax, erysipelas of the lung and phthisis. The symptoms of the last were described in a masterly fashion, those to which the greatest prominence were given being: alteration in the voice, pain in the back and chest, fever, offensive nature of the dejecta, diarrhoea, falling of the hair etc. The dissection of animals had made them familiar with *φύματα*, i.e. circumscribed inflammatory foci which break down into pus and lead to cavity formation. Accumulation of mucus and expectoration of blood were held to be the causes. The chief remedies were: good feeding (particularly with milk), diluted wine, lentil water, hellebore and cauterisation of the chest.

Diseases of the heart. On account of the two-fold nomenclature *καρδίη* meaning both heart and œsophagus, it is in individual cases difficult to decide what is meant in any given Hippocratic description. In "De morbis" iv. it is stated that the heart cannot be the seat of pain and, on account of its strong, thick structure, does not suffer from congestion of humours.

The Hippocratists were familiar with the most important nervous diseases so far as the characteristic associated symptoms were concerned, but of the correct pathological explanations there could hardly be any question, since no clear conception of the anatomy of the nervous system had been evolved. The cause of disease is always phlegm, coming from the head, leading to different symptoms according to the place in which it accumulates. (In the writing "De locis in homine" the statement occurs that the "nerves" are drier than the "arteries" and cannot convey moisture, wherefore their disorders are characterised by great obstinacy.) Obstruction of the vessels by phlegm, making them impervious to blood or pneuma, was the cause of apoplexy and paraplegia, gout and rheumatism, and it is important to note that the atrophy following upon paralysis was known, also the fact that in the course of spinal disease paralysis, anaesthesia and incontinence of urine and fæces occurred. Excellent are the descriptions of opisthotonos and tetanus, of facial paralysis, hysteria and epilepsy. The author of the book "De morbo sacro" knew the significance of heredity and described the symptoms of epilepsy most naturally. The cause of the disease is referred to excessive determination of phlegm to the head, unconsciousness being due to the phlegm entering the veins suddenly, hindering access of air to the veins of the brain; convulsions are explained by the air, dammed back by the phlegm, forcing itself upwards and downwards through the blood.

The strictly psychical affections were not distinguished from such as were only secondary (e.g. feverish illnesses), a common origin being ascribed to both, viz. disturbances of the cardinal humours, as is seen in the name melancholia. Other such affections referred to by the Hippocratists were: puerperal mania, delirium in phthisis and melancholy in

chlorosis. Treatment was undertaken directly against humoral disturbances (hellebore in melancholy) or indirectly by diet, gymnastics, etc. The ætiological significance of heredity receives no mention. The conception of constitutional disease is wanting in Hippocratic medicine: thus scrofulous swellings were mentioned, but recognition of such as local manifestations of a general infection was yet to seek. A dim forecast of the existence of disease-processes is found in the view of dropsy, which was traced to a variety of causes such as liver and spleen affections. Varieties of dropsy were plain "hydrops," œdema and anasarca. Paracentesis was carried out by means of an incision near the navel or in the side.

Upon the meaning of the skin diseases, ulcers and tumours described by the Hippocratists great difference of opinion exists amongst investigators, in spite of the voluminous terminology which has persisted to the present day.

Amongst parasites tape-worms, thread-worms and ascarides were known. Noteworthy are numerous descriptions of diseases of the uropoetic system, cystitis, lithiasis, pyelitis, nephritis, acute and chronic renal abscesses. Special weight was laid upon examination of the urine by smell, colour, sediment etc. Amongst the diseases of the male generative organs were described metastatic swellings of the testicles, hydrocele, ulcers and venereal warts on the prepuce, possibly, in one place, gonorrhœa.

Surgery, no less than medicine, stood at a high level, only comprehensible as the consummation of a long development. Nowhere more than in this branch could careful observation of nature, coupled with temperate views, achieve such triumphs, wherever faulty anatomical knowledge did not stand in the way of daring enterprise. The diagnosis and treatment of disease and injury of the osseous system serve as a pattern for all time, also the treatment of wounds, in which antisepsis is already heralded, and the art of bandaging (*mitra Hippocratis*), which knew how to combine usefulness with a regard for appearances.

Diagnosis and treatment of dislocations and fractures, and particularly injuries of the head are treated of in the book "*De articulis, de fracturis, de capitis vulneribus*" in a manner nothing short of masterly. It is founded on a sufficient knowledge of the human skeleton and on the widest experience for which the frequent injuries occurring in the gymnasia and athletic schools afforded ample opportunity. With admirable courage the surgeons undertook trephining, thoracocentesis, paracentesis abdominis, nephrotomy in abscess of the kidney and such operations, like that for polypus, hæmorrhoids, fistula in ano, where, either no appreciable loss of blood was caused, or which could be carried out in a bloodless manner. Extirpation of large tumours, and, what is especially surprising, amputation in the strict sense of the word, the Hippocratists were thus unable to perform, since the most important of all hæmostatic methods, ligature of vessels, was still unknown (amputation of members was only undertaken in gangrene of the extremities, and then only below the line of demarcation). Means of arresting hæmorrhage were, in addition to various styptics,

elevation and compression, tamponage and bandage,—less often the cautery.

In the treatment of surgical affections, besides purgation, venesection and diet, there were employed a number of medicaments (in the form of salves, plasters, poultices and caustics), local cold (ice, snow and affusions) and heat, bandaging, cauterisation, moxibustion, cupping, scarification and a variety of appliances (splints, orthopædic shoes etc.) The writings “*De medico*” and “*De officina medici*,” wherein the most minute descriptions were given upon the position of the patient, the attitude of the physician, state of the nails, duties of assistants, regulation of light, correct application of bandages, compresses and splints etc., throw light upon the richness of the instrumentarium employed with care and circumspection by the Hippocratists. To this belonged sponges, cupping-instruments (of horn, glass and bronze), cauteries, probes, spatulæ of different sorts, hooks, needles, lancets, bistouries, the raspatory, trephines, cannulæ attached to bladders of animals (instead of syringing, for the injection of fluid or air into cavities), bent catheters, rectal specula, punches, dental forceps etc. Instead of metal cauteries there were also used similarly shaped wooden instruments or sponges soaked in hot oil; as enema syringes were used animals’ bladders fitted with quills as nozzles.

For examination were employed probes (of lead, tin or brass) as rectal specula the hollow stems of the garlic plant (in order to measure the depth of fistulæ).

It was considered a sign of lack of surgical dexterity if “. . . one fails to notice the presence of pus in a wound or abscess; if fractures or dislocations are overlooked; if, in probing the head, a fracture of the bone be not noticed; if one should fail to pass a catheter into the bladder; if the presence of a stone in the bladder be not recognised; if, in succussion, one should not realise that an empyema is present; if, in cutting or burning, one should make a mistake in length or breadth, or if one should cut or burn where it is unnecessary.”

Wounds and ulcers were not sharply differentiated by the Hippocratists. The fundamental principle of treatment of wounds consisted in rest and correct position of the injured part. Freshly inflicted wounds were kept as dry as possible, whilst to prevent inflammation bleeding was encouraged; they were also treated with poultices (made of plants, in case of necessity, of cold meal-pap); stitching was also known. Bruised or torn wounds, on the other hand, were encouraged to suppurate as soon as possible so as to promote elimination. Apart from individual and accidental considerations, which might determine prognosis, the Hippocratists looked upon injuries to the throat and groin as the most dangerous, then those of the brain, spinal cord, heart, diaphragm, liver, stomach, wounds of the intestine, wounds of the bladder and injury to a vein leading to hæmorrhage. Penetrating wounds of the chest were held to be fatal; inflammations of the tendons and muscles were supposed

always to lead to incurable lameness; the dangerous complications of wounds, such as erysipelas, tetanus etc. were not overlooked. There is a masterly description of head injuries, of which five forms were recognised, namely, fissure (with contusion), contusion (without fracture or depression), wounds of the bone and contre-coup leading to fracture. In doubtful cases the wound was to be enlarged (but never on the temples for fear of tetanus), or the bone was to be scraped with the raspator. The most important means of cure was trephining (generally performed on the third day), the Hippocratists being already masters of the complete technique of this operation and making use of the perforation as well as the crown trephine; for fear of injuring the dura mater the skull was bored through only to the inner table. Paralysis of the opposite side of the body as a result of head injuries was noted. The teaching upon fractures and dislocations stands as the highest achievement of Hippocratic medicine. Of fractures, simple and compound were distinguished, from the point of view of prognosis, the different duration of the healing processes was noted (callus was supposed to originate in the bone-marrow), whilst the lines of treatment laid down have served as a guide for all later time. In a manner both wonderful and rational, every detail was prescribed, how to carry out the setting (not later than the second day), how to bandage, how to apply the splints etc., what complications to avoid or to prevent. The typical dressing was applied in the following way. The site of the fracture was first covered with a short and loose bandage, upon which followed a longer one which served to fix the fracture. On these inner bandages were placed compresses smeared with a salve containing wax around the seat of fracture whilst, partly to fill up the inequalities, partly to cover the whole, two long external bandages were applied, of which one ran from right to left and the other in the opposite direction. Every three days the dressing was changed with addition to the number of bandages; on the seventh day the splints were applied, at first only loosely, then more and more tightly. For the arm slings were used, for the lower extremity hollow splints. Apparatus for permanent extension was also known. Concerning compound fractures it is noteworthy that the Hippocratists, like modern surgeons, distinguished three stages, primary, intermediary and secondary—and in the intermediary stage considered operative interference dangerous. To bring about reposition various devices were employed; following very definitely laid down indications, resection of protruding ends of bone was practised.

The symptomatology and treatment of dislocations is handled in the Hippocratic writings in a manner which, in many chapters, has hardly been surpassed. This holds true in particular for the dislocations of the shoulder, hip and jaw. Manual and mechanical methods are carefully described. Reduction of the displaced humerus was effected by the hand, the heel or the opposing shoulder of the surgeon, or by means of a stick or a ladder, assistants keeping up extension and counter-extension. In cases of old-standing dislocations the "Ambe" came into use (a setting-board, to which the limb was firmly bound and by means of which a variety of powerful leverage movements could be carried out), or the arm of a high Thessalian chair. Reduction of the femur was effected by a complicated arrangement, which made fixation of the limb possible, whilst the dislocated extremity could be subjected to strong pull and counterpull. It speaks highly for the keen clinical insight of the Hippocratists that they distinguished different varieties of dislocations, according to their anatomy and recognised them as complete and incomplete, acquired and congenital (of the hip). They realised that compound dislocations were highly dangerous, that old-standing ones, on account of the covering of the articular surfaces by "flesh" and through the formation of pseudarthroses, presented great obstacles to reposition; that long-continued immobility led to muscular atrophy; that as a result of habitual laxation of the humerus growth of the arm was delayed; that disease of the joints led to spontaneous dislocation.

Spinal curvatures, either traumatic or spontaneous (from *φύματα*) in origin were quite accurately described together with their results (abscesses); and it is particularly interesting

to note that even the presence of tubercle in the lungs of patients with kyphosis is recorded. Various kinds of club-foot were recognised, this being looked upon as a congenital dislocation, and in its treatment suitable bandages, mechanical apparatus etc. were used, on rational principles. Herniæ in the groin or at the umbilicus are little mentioned in the Hippocratic writings.

Hæmorrhoids, considered as a retention of phlegm or bile in the veins of the rectum, were treated by direct or indirect cauterisation, (in the latter method a hot iron was introduced into a shell placed in the rectum) caustics, excision, suture and astringent suppositories. Here, as with fistula in ano, the rectal speculum (κατοπτήρ) was employed in examination.

Fistulæ, the depth of which was measured by means of fresh garlic stalks, were healed by astringents or ligature. The necessary and comparatively difficult technique shows the dexterity of the Hippocratic surgeon. Prolapsus ani was replaced and kept in position by a sponge and a T-bandage.

Lithiasis—of frequent occurrence—was supposed to be caused by drinking water containing lime or sand.

Lithotomy, like castration, seems to have been relegated to the empirics.

Abscesses in the neighbourhood of the kidneys, also possibly due to stone, were treated by nephrotomy, as soon as swelling and tumefaction became visible.

Obstetrics and gynæcology rested in part upon a foundation of considerable knowledge, mixed, however, with speculations upon natural philosophy or *a priori* conclusions from observations upon animals. Obstetrics was almost exclusively in the hands of the midwives, medical help being only requisitioned in difficult cases; even in gynæcology examinations seem to have been undertaken principally by midwives and skilled women, the physician directing the treatment mainly in accordance with their findings.

The Hippocratists considered only vertex presentations as normal, which they explained as due to the gravitation of the heavy head; besides these they knew breech, transverse, and partial and complete foot presentations. In complete foot presentations they either took no action or else they practised shaking of the parturient woman or turning by external, internal or combined methods. Prolapse of the arm in transverse presentation was thought to indicate death of the child and was an indication for embryotomy, which was carried out by means of a crushing instrument and a hook. The stool of delivery, the forceps, Cæsarian section and ligature of the cord are not mentioned. Removal of the retained placenta was thus accomplished. The woman took her seat upon a chair with a hole in it, which was at other times used for vaginal fumigations, whilst the child, with the cord still unsevered, was placed upon leather water-bags on the ground. These bags were then pricked, so that their contents slowly escaped, by which means the child gradually sank and by its own weight brought away the placenta. A series of clinical histories deals with puerperal fever, which was supposed to depend upon retention of the lochia.

An important cause of abortion, which was known to recur at the same time in repeated pregnancies, was held to be a disproportion between the development of the child and that of the uterus; to prevent it various medicaments were employed, locally applied on probes, pessaries inserted, and obesity was induced. Frequently the induction of abortion was attempted by means of abortifacients, of which there were a number (as there were also of means of preventing conception), also by shaking. It was, in this connection, advised by the author of "De natura pueri" that the patient repeatedly jump up into the air, and at the same time kick the heels against the buttocks.

The subject of diseases of women is treated in great detail by the Cnidian authors. Mention is made of ulcers and hypertrophy of the labia, amenorrhœa, a variety of discharges, narrowing of the os uteri, hæmorrhage, inflammation, prolapse, versions, carcinoma of the uterus; the methods of treatment, so far as they are directed against the frequently resulting sterility, are distinguished by their variety. Hysterical affections were traced to migration of the uterus, as only thus could the protean symptoms (such as the sensation of globus) be explained. In order to bring the uterus back to its normal position (wherein empiricism acted rightly, only the theory being wrong), mechanical means were employed, such as pressure, bandages, etc., or fumigations either with evil-smelling substances, which were allowed to act through the nose, or pleasant-smelling ones acting upon the vagina. The former method was intended to repel, the latter to attract the uterus. The system of fumigation-therapy, as well as many of the means of recognising fruitfulness and pregnancy, or of prevention of conception, are vividly reminiscent of Egyptian and oriental models.

Pediatrics has also a small place of its own in the *Corpus Hippocraticum*. Deformities, congenital dislocation, various diseases of the mouth, spasm, eruptions on the head, ear and nose, catarrh, cough, obstruction, etc. are described; acute hydrocephalus and diphtheria are at least hinted at.

Ophthalmology was, as far as the diseases of the external parts of the organ of vision are concerned, fairly far advanced; knowledge of the pathology of the inner eye was hindered by the lack of anatomical knowledge.

External diseases of the eye were carefully described by the Hippocratists. They were familiar with acute and chronic conjunctivitis, severe blenorrhœa, trachoma, pterygium, marginal blepharitis, sty, en- and ectropion, trichiasis, corneal ulcer and strabismus. They mention darkness and swimming before the eyes, nystagmus, nyctalopia, hemianopia in brain affections, but they had confused and erroneous notions concerning the refractive media. Blue colour of the pupils indicated future cataract, "amblyopia" is caused by flow of phlegm from the brain, "amaurosis" by fever, loss of blood and injury in the neighbourhood of the eyebrow. With the exception of operative measures for tumours, anomalies of the tarsal cartilages and hypopion, and of chemical and mechanical irritation of the mucous membrane, the therapeutics of the severe inflammations and of amblyopia were influenced by the idea that disturbances of vision were due to pathological determination of phlegm from the brain. Besides purgatives surgical means were employed, which were intended to arrest the flow of phlegm, to hinder the determination of morbid material to the eye (by closing the vessels) and to get rid of the accumulation of fluid in the brain. Such measures were repeated incisions through the skin of the scalp right down to the bone, cauterisation of the "continually pulsating" vessel in front of the ear and trephining.

Otology was bound, on account of the poverty of anatomical knowledge, to remain at a low level; it is surprising, however, to find an understanding of many inter-relationships between diseases of the ear and those of the body in general; the treatment of hæmatoma of the ear, of fracture of the cartilage and otorrhœa are minutely described.

THE DOGMATISTS

THE Hippocratic ideal, however seldom realised, yet lives, unfettered by doctrines, throughout all time. In the course of Greek medical history, however, it stands as a dream, all too quickly followed by an awakening to a reality full of discordant notes. In Hippocratic medicine lay hidden the germs of ideas rich in potentiality, and it had been successful in uniting previously divergent tendencies towards a common practical goal. Individual ideas and methods gradually separated themselves to obtain, through independent development, an evanescent supremacy in medical thought and professional activity. New influences arose; the single system gave place to many, most of which attempted indeed to maintain a traditional connection with the "Father of medicine," but in reality with the lapse of time Hippocrates was reduced to a mere abstraction to which alien thoughts and opinions were arbitrarily ascribed.

Unfaithful to the dispassionate, purely clinical intellectual method of the great Coan, a considerable portion of the Hippocratic Collection is pervaded by the speculative spirit, proof that his disciples and their pupils aimed either at bringing the practical principles of Hippocratism into harmony with *a priori* ideas derived from natural philosophy, or at reinforcing Coan fundamentals with the physiological and pathological theorems of other schools. Striving to outdo the master, to dress his empirical dicta in a garb of pseudo-science, the tendency grew to consider as vital what to him was unessential and accessory, and thereby only too frequently to lose sight of the gist of his teaching.

How soon this occurred is shown by the dogmatic formularisation of humoral pathology at the hands of Polybos and by the fact that the sons and grandsons of Hippocrates as well as his immediate disciples, Apollonios and Dexippos, were at the head of that series of physicians who laid emphasis upon theoretical conjecture and gave to medicine in the fourth century B.C. its speculative colouring.

Known by Galen and all later historians as Dogmatists (λογικοί), the leading investigators added not a little to their inheritance of empiricism or, what is most to their credit, laid the foundations of the ancillary

sciences. Their followers, however, were largely subservient to a morbid love of system and made too important a feature of intellectual but fruitless juggling with the doctrines of humours and qualities, whilst they prematurely forced inherited experience into the narrow mould of their own thought, greatly to the detriment of therapeutics. Knowledge of the works of the dogmatic school has come to us only through quotations and fragments.

Thessalos, the son of Hippocrates, later court physician to Archelaos, king of Macedonia, is supposed to have been the author of medical writings; he considered the excessive secretion of bile and particularly of phlegm to be causes of disease.

The son of Thessalos, Hippocrates III., was an adherent of platonic philosophy.

Dexippos and Apollonios were also writers; the former wrote a medical work in one volume, "Prognostics" in two, and sought the causes of disease in anomalies of bile and phlegm. If the bile and phlegm melt and become more fluid, then lymph and sweat are formed; if, however, they become thicker and stagnant, tinnitus, coryza and running at the eyes result; if they become firm by drying up, flesh and fat are formed. Apollonios and Dexippos gave fever-patients only very small quantities of nourishment and minimum amounts, accurately measured, to drink. Their contemporary Petronas went even further in the "dogmatic" treatment of fever, he covered fever-patients with a quantity of clothes, in order to produce heat and thirst; upon remission of the fever he administered large quantities of cold water in order to bring about sweating. If this did not occur, the patient had to drink yet more cold water, whilst expulsion of the fever was sought by exciting vomiting or purgation. With reference to his theories it may be mentioned that he held diseases to be produced by excess or faulty admixture of the elementary humours, wherein the cold or warm overpowered the complementary dry and moist. In harmony with the views of Philolaos he looked upon bile as a product rather than a cause of disease.

The fate which Hippocratism met at the hands of its adherents is exactly comparable with the transformation process which the doctrines of Socrates underwent to reappear in a wholly new guise as the systems of the Cynics, Cyrenaics and Megarics and especially as the philosophy of Plato.

Here also, in the circle of Socrates' disciples and their pupils, the master's principles were found to require amplification, and that restriction of the domain of research to ethics, which a wise self-restraint had dictated, was no longer considered sufficing.

The Socratic analysis of ideas now became rather the means wherewith to adopt and prosecute, with critically cultured judgment, the physical or metaphysical speculations of the antecedent nature-philosophers.

The outstanding greatness of Plato rests not least upon the happy combination and intimate blending of Socratism with the ideas of the Eleatics, of Heracleitos, Anaxagoras, Empedocles and Pythagoras. Springing from a common root, running a parallel course, philosophy and the healing art come into close relationship. The former had recently chosen

nature as the object of her speculation ; the latter, if no longer neglectful of appeal to medical experience, had yet adopted many postulates from the systems of the great thinkers.

Plato himself, who held the physician Hippocrates in high esteem for his idealised ethics and far-seeing views upon nature and who took his methods as a pattern (if not quite in the sense of the founder), included physiological and pathological problems within the scope of his all-embracing intellect.

In various places, particularly in the writing "Timaïos," he makes special mention of inter-relationship between the two branches of knowledge.

If platonic philosophy cannot be credited with any marked influence upon contemporary medicine—this only made itself felt later, when the system had lost much of its pristine purity at the hands of its exponents—yet the competent expositions of the philosopher afford a most instructive insight into the knowledge of the period concerning the structure of the human body and current views upon life and disease.

Of platonic physiologico-pathological speculations, only a few can be here enumerated, which show clearly their connection with earlier natural philosophy and with the conceptions of the physicians.

Plato regarded the world of the senses from the point of view that in it the archetypes of the world of ideas were embodied, ever approaching nearer to perfection, and he sought the ultimate cause of the formation of matter in the idea of Good, *i.e.* of God.

The supreme intellect creates out of the chaos of matter the four elements, which owe their characteristics to the peculiar combinations of elementary triangles into certain fundamental figures. That of fire is the pyramid, that of air the dodecahedron, of water the eikosahedron, of earth the cube. The body of man is fashioned to the needs of the immortal soul which represents an emanation from the absolute intelligence. The link between body and soul is the marrow, the appendage to which, the brain (spherical and therefore most perfectly formed), is the seat of intellect. The mortal lower constituent parts of the soul, disposition and passion, are located, the first in the breast, the second in the belly.

Of the instruments of the soul the eyes are the first to be formed ; vision results from the meeting of the inner fire, emanating from the eyes, and the outer ; hearing from ærial vibration which is communicated to the brain and blood.

Life is bound up with fire which originates from the pneuma and is inherent in the blood. This, forcibly driven through all the members, nourishes the body and has as its source the heart, where all veins meet. A cooling influence is exercised upon the blood by the lungs, which take up, not only air, but also some of the fluids imbibed. The latter reach the kidneys and bladder by way of the lungs. The mechanism of respiration is explained by the "horror vacui," the specific nourishment of the parts by the law of attraction of likes.

The liver, shining and smooth as glass, suitably alters, by means of its sweet and bitter principles (bile), materials derived from the head. In intimate relation with this stands the spleen, which serves to absorb impurities and hence is enlarged in disease. Digestion is brought about by the inspired fire ; the intestines are arranged in convolutions to prevent the food passing through too rapidly. Bone and flesh are derived from marrow ; both serve to protect it from heat and cold. Intermediate between bone and muscles are the tendons, just as yellow is a composite colour of red and white : they serve to keep the joints in appo-

sition and to move them. Clear as is in these speculations the indication of the theories of precedent nature-philosophers, particularly Pythagoras, Empedocles, Philolaos, Anaxagoras and Heracleitos, evident as is the note of Hippocratism, these influences are yet stronger in the platonic theories of disease. The philosopher recognises as ætiological factors those which come from without or those due to the patients' own acts, as immoderate diet, disproportion between exercise and eating, sexual excess.

Underlying causes are : deficiency, excess or displacement of the pneuma, bile or phlegm, or disproportion between the four elements. Epilepsy results from mixing phlegm and black bile ; inflammations, dysentery and diarrhœa from disturbances of the phlegm ; the most dangerous diseases are caused by pathological conditions of the marrow. It is noteworthy that Plato traces the cause of many diseases to disturbance of the pneumatic circulation, especially pain and cramps from its accumulation or invasion (into the firm flesh) and that he explains the incidence of four types of fever by predominance of the individual elements. Thus continued fever is caused by fire, quotidian by air, tertian by water, quartan by earth. The causes of mental disease are bad bringing up or bodily abnormalities. Drugs timely administered, or better, diet and gymnastics, bring about a cure.

The speculations of Plato arouse an additional interest since they betray the growing influence of the Sicilian school (see p. 118) in addition to that of the Coan and Hippocratic doctrines.

We know from the biography of the philosopher that Plato had become acquainted with the spokesman of this school, Philistion of Locroi, an expert botanist as well as physician, together with the statesman Timaios, in Syracuse at the court of Dionysios. Many indications point to the fact that Philistion was, at a later date, a temporary inhabitant of Athens—a circumstance of no little importance for the future of the Dogmatic theory.

It fell to Philistion to secure for the achievements and theorems of his school wider publicity through intercourse with leading exponents of other tendencies. He thus indirectly paved the way for the amalgamation, after many metamorphoses, of the Sicilian with the Coan and Cnidian doctrines.

Of the Cnidians we know that Eudoxos of Knidos (the younger), even more celebrated as astronomer and geographer than as physician, visited upon his journeys not only Hellas and Egypt, but also Italy and Sicily, where he came into contact with Philistion. The manifold impressions made upon his medical speculations by this association with Egyptian priests, Pythagoreans and Italian physicians, are most evident in his pupil Chrysippos of Knidos, the companion of his journeys, whose wide knowledge owed no little to the guidance of Philistion. From Philistion Chrysippos derived his taste for anatomical dissection, and it may have been the influence of Sicilian as well as Egyptian doctrines which converted him into a pronounced adherent of pneumatic tendencies in pathology and a protagonist of dietetic procedure in therapeutics.

Many of the methods and views of Chrysippos won acceptance and exercised considerable influence upon later physicians. Amongst these were his predilection for drugs, which he learnt to value in Egypt, his rejection of venesection (blood is the seat of the soul) and purgatives, in the place of which he recommended emetics, enemata, bandaging of limbs (binding arms and legs in plethora or hæmorrhage to reduce overfilling with blood) and prohibition of drinking in feverish conditions.

Even the Hippocratic school was not entirely outside the sphere of Philistion's intellectual activity, the workings of which are notably in evidence in its foremost representative in the first half of the fourth century, Diocles of Carystos. The remains of his multifarious writings which have come down to us show many accordances with Plato and indicate a common origin for many of the parallel passages from the Sicilian thinkers.

The experienced and temperately observant physician of Carystos, called by his fellow-citizens on account of his philanthropy and culture by the name of ἄλλος Ἰπποκράτης, was indeed no blind partisan. He made critical selection of those elements alone of a foreign doctrine which seemed to him a useful complement or correction of Coan views and compatible with his own investigations, which he did not fail to pursue.

Diocles of Carystos, son of the physician Archidamos, founded his knowledge upon study of the Hippocratic writings, but also undertook journeys for the sake of extending his art abroad at various seats of medical learning. It appears that for some time he pursued his activities in Athens, the centre of Hellenic culture. He published in the Attic dialect a considerable number of excellent works, bearing titles partly identical with those of the Hippocratic Collection. Like these, his writings dealt with the most widely different subjects and during centuries served as sources of instruction.

Diocles, the greatest physician after Hippocrates—*secundus ætate fama*que, as he was acclaimed by Pliny—turned his attention to the kindred sciences, to anatomy, embryology, materia medica, and toxicology, in addition to clinical medicine and, if not free from system-mania, he balanced actual observation and practical experience against speculation.

His industry in zootomy, the results of which Diocles laid down in a special work on anatomy, enriched the subject as it had not been enriched since the time of Alkmaion. In particular, he busied himself with the vascular system, regarded the heart as the source of blood and distinguished two main branches, the *παχέα ἀρτηρία* (aorta) extending to the kidneys and bladder, and the *κοίλη φλέψ* (vena cava), both giving rise to "veins." Of veins he described more than his predecessors, the nerves he distinguished from the vessels as little as they. He mentioned "ducts" leading from the liver to the gall-bladder, the "œsophagus," "cæcum," ileocæcal valve, ureters, ovaries and Fallopian tubes.

His physiology is strongly influenced by the Sicilian school. The heart (on the left) is the seat of the soul in the shape of inherent pneuma, which influences movement and sense-impressions. The pneuma is renewed by means of respiration, which also serves to cool the heart, and it spreads itself by means of the veins along with the blood to the brain and remaining parts of the body. Nourishment occurs through the blood which is prepared in the liver; digestion in the stomach is a form of putrefactive process, promoted by the inherent warmth; waste products of food reach the intestines and bladder, but are in addition got rid of by the sweat and exhalations.

Diocles also wrote upon poisons and pharmacology. His *ρίζοτομικόν*, the oldest herb-book of the Greeks, contained important instructions concerning origin, recognition, nutritious value and medical uses of plants and was much used by all the later authors.

Diocles sought to outvie Hippocrates in so far as he commenced to elucidate the problems of the ætiological relationship of symptoms and the seat of disease in the light of anatomico-physiological considerations. In this respect his assertion is remarkable that fever is only a resultant symptom of other morbid processes (*e.g.* wounds, inflammations, obstruction to the pneuma), as is also the distinction between a splenic and hepatic form of ascites, the distinction between pleuritis and pneumonia, the latter of which was supposed to be localised in the vessels of the lung, and the distinction between obstruction of the small intestine and the large. It may easily be understood how such attempts accurately to delimit the path of natural science led to error such as is expressed in the statement of Diocles, following the specious Sicilian pneuma-theory, that mental disorders are localised in the heart (since the pneuma has its central seat at the meeting-place of the air-conducting vessels, *i.e.* in the heart).

Such theoretical vagaries did not, however, influence Diocles' practical medical procedure, for in this he was linked by an indissoluble bond with Hippocrates.

Like the latter Diocles laid stress upon semeiosis and prognosis (with especial reference to season, climate and individual methods of life), and was an exponent of the therapeutic axiom that no local complaint is curable without taking the constitutional condition into consideration.

Diocles' pathology may be looked upon as a species of compromise between Coan and Sicilian theories. It is based upon the assumption of the importance for organic functions of two factors, the pneuma and the four elements or qualities. Through the influence of the elementary qualities blood, phlegm, yellow and black bile are evolved from food; these are looked upon by Diocles as cardinal fluids, but not as primary elements of the body. Except in the case of external injuries diseases arise through abnormalities of the elementary qualities or disturbance of the pneumatic circulation.

Inflammation is blocking of the blood-vessels. Phrenitis he considered as inflammation of the diaphragm, melancholia as arising from accumulation of black bile in the heart (according to the Coan teaching, in the brain); lethargy arises from coagulation of the blood around

brain and heart; epilepsy and apoplexy are brought about by obstruction of the aorta by phlegm. Surgery and gynaecology received great attention at his hands.

Amongst causes of sterility Diocles enumerates displacement of the uterus, a conclusion arrived at from dissection of mules; dystocia he considered due to abnormal position, induration or closure of the os uteri, to abnormal size, defective development or death of the embryo. To remedy prolapse he forced air into the uterus and following reposition he introduced a pomegranate, peeled and soaked in vinegar. In his dietetic writings he adopted the Hippocratic point of view entirely and laid down minute directions for every hour of the day, for the morning walk, for washing, for cleansing the teeth, for sleeping and so forth. In opposition to his father Archidamos he opposed dry friction and recommended inunction in its place.

Following in the footsteps of Diocles, but outlining more sharply the new tendencies, came his contemporary, disciple, and successor in the leadership of the dogmatic school, Praxagoras of Cos (who flourished ca. 340–320 B.C.). In his hands many of the cautious premises of Diocles are seen leading to unwarrantable deductions by no means always advantageous to practice. The numerous writings of Praxagoras deal mostly with anatomy and physiology, materia medica, diagnosis, diet and gymnastics.

Praxagoras, like Diocles, looked upon the heart as seat of the soul and, through the pneuma, as centre of sensation. He, however, drew a clear distinction, previously only hinted at, between arteries and veins, asserting that only the latter contained blood, the former being exclusively filled with air, whilst he traced the origin of the conducting nerves (although confused with tendons and blood-vessels) to the heart. He did not look upon the body-warmth as inherent but acquired, whereby he not only shook the then accepted views upon respiration, but laid the foundation of later mechanical theories.

The most interesting fact about Praxagoras is that he attempted to develop differential diagnosis of diseases, causal explanation of symptoms and their associations, and knowledge of sequelæ by uniting exact investigation to the predominating speculation—an endeavour that found expression with him as with Diocles in a more accurate technical phraseology. Examples of his tendencies towards topical pathology were seen in his localisation of the seat of fever in the vena cava, of mental diseases in the heart, his explanation of epilepsy as caused by obstruction of the arteries through phlegm, and his record of the local pathological conditions found in pleuritis.

With full recognition of its significance Praxagoras was the first to raise the pulse to the position of a valuable diagnostic aid, and he allowed himself, on anatomico-physiological grounds to be led to adopt (particularly in surgery) therapeutic measures, frequently of a most radical nature.

The path marked out by Chrysippos, Diocles and Praxagoras was followed by adherents and disciples. Much was achieved in the domains of anatomy, materia medica and dietetics, that was of service in later

scientific development. Xenophon of Cos, Pleistonikos, Philotimos, Mnesitheos and Dieuches of Athens were praised by later authors in this respect; Euenor of Argos seems to have distinguished himself as a therapist, particularly in obstetrics and ophthalmology.

The pathology of the dogmatists was largely founded upon speculation, in the vortex of which not only therapeutics but also unbiassed clinical observation was engulfed, the latter being displaced in favour of one-sided hypotheses. The precepts of the great Coan had, in premature striving after scientific finality, been widely departed from; especially was that individualising tendency, which saw every case as a problem in itself, in process of extinction. In the light of modern knowledge it is doubtless easy to pronounce "Dogmatism" as a mental aberration and to ridicule the fantasies of humours, elementary qualities and influence of the *pneuma*. However, a deeper comprehension of the genius of the age, and of the development of medical thought makes it possible to see these aberrations as they really are, links in the chain of evolution, the product of the times, whose function it was to resolve into its elements the Hippocratic conception of the *Physis*.

It was at once the triumph and the stumbling-block of Hellenic intellectual life that, together with a richly endowed intuition, a leaning towards the highest abstraction so early awoke. The generalising propensity conduced to scientific advance, and sprang from that economic impulse which led to the pursuit of ultimate principles in order that the intellect might temporarily be eased of the burden of endless minutiae, and that their repeated and continuous observation might be dispensed with.

Deductive processes are not of themselves followed by injurious consequences, but only deduction from unsound and false premises. At that early epoch the most prevailing principles were not the product of a reliable, broad series of inductions, but were rather based upon incompletely established premises or even only upon brilliant inspiration. Medicine as a component factor in the common intellectual life remained the less free from this tendency in that it had before it the example of science. Hippocrates, who clearly indicated the insufficiency of the premises of the deductive method, was an exception, and with his pre-eminent critical faculty, represented only a passing phase. Induction, exclusively enjoined by him, restricted medicine to practical purposes, to the construction of a symptom-complex in each individual case, to prognosis and to treatment, made dependent upon the foregoing.

This restriction was no arbitrary one, since induction from purely clinical symptoms throws light upon the results of the clinical condition but not upon its causes. In order to arrive at any certainty upon the latter a further series of inductions is requisite, drawn by modern medicine from the domains of pathological anatomy and experimental pathology—a series which does away with all necessity for hypothetical and disjunctive conclusions. There was on the one hand a genuine thirst for knowledge, leading to a keen pursuit of pathogenesis; on the other, economy of thought, which in place of a prognosis laboriously acquired in each separate case, sought to arrive at a diagnosis by a far shorter road, and therewith at conclusions upon prognosis and treatment. This led to the search for foundations upon which to base the hitherto necessary hypothetical and disjunctive assumptions. Here is found the starting-point of the dogmatists, viz. that they considered as ample material a speculative

physiology, which appeared to justify the ancient humoral and pneumatic doctrines, in addition to newly acquired anatomical facts. The later schools for the most part followed them along these lines. Continual correction through practical experience, with the necessary sequence of new, altered or amplified premises makes up the content of medical history and explains the diverse phenomena of its fluctuating process of development.

The tendency of rationalist physicians to unveil the nature of the *Physis*, the existence of which had been merely laid down as a principle by Hippocrates, arose from a growing thirst for knowledge which stimulated investigation into the ultimate causes of every sensory experience. Deduction, however, assumed a greater prominence than more legitimate measures, since the fashion was set by contemporary leaders of science and no less a man than Plato considered indulgence in wildest speculation justifiable.

How little calculated even the most important teachings of technical and empirical knowledge were to keep thinkers to the strait path of inductive research is most clearly shown by the doctrines of Aristotle (384-322 B.C.). His system, through its positive foundations, through its all-embracing elaboration of a superabundant store of matters of fact, constituted for medicine a pattern of empirical collective investigation, and on account of its uniformity of method may even to-day be looked upon as the unattained ideal of scientific endeavour, whilst yet it paved a way, more than any other system, for the victory of the deductive method.

The intimate intermingling of speculation and empiricism is well shown in Aristotelian anatomy and physiology, both of which, treated from a teleological point of view, remained through many centuries models of scientific perfection. In anatomy the Stagirite was not neglectful of the labours of his predecessors and of Diocles amongst contemporaries, nor did he fail to advance the subject, particularly in knowledge of the vessels, but it contained many serious errors, arising, partly from unwarranted deductions drawn from the results of zoological dissection, partly from preconceived opinions.

A notable contribution was the foundation of general anatomy, according to which conception like tissues of the body (*homoiomorous*) are immediately produced from the four elements. These tissues are: veins, tendons, connective tissue, bones, cartilage, horn, skin, hair, membranes, flesh, fat, blood, marrow, milk and semen, from the blending of which the organs are first derived. In comparison with previous knowledge upon this subject embryology made great strides through study of the development of the embryo in the hen's egg, of the formation of heart, brain, eyes and allantois with the vessels of the yolk-sac. In physiology, Aristotle

allowed himself to be biassed by an often naive teleology, and set too narrow limits to the sphere of action of a causal mechanism. He traced the dynamics of function ultimately to the activity of the nourishing (and perpetuating), perceiving and moving psyche, *i.e.* to organic forces—a method which later became the cause of centuries of stagnation in the investigation of vital processes.

Amongst other deficiencies of Aristotelian anatomy may be mentioned:—a distinction drawn between the sutures of the skull in men and women; the statement that the number of ribs is eight; that there are three chambers of the heart, the interauricular septum being overlooked; that the kidneys are lobulated. Aristotle held the heart to be the centre of the vascular system; he was familiar with the aorta, vena cava and their branches and tributaries, which he followed up in their further course, albeit inaccurately and without distinguishing arteries from veins. According to him the spermatic arteries contain no blood, but pneuma and water. The human brain is larger and moister than that of animals, but bloodless and cold; the spinal cord, on the other hand, which is looked upon as identical with bone-marrow, is warm. The expression *πόροι* signifies not only nerves, which had not yet been differentiated, but also tendons, ligaments and ureters. The uterus is still considered to be bicornuate.

Aristotle's physiology, although too much permeated by metaphysics, for the first time accurately defines the nature of organic life, spontaneous movement being the accepted criterion. Taking his stand half-way between primitive materialism and spiritualism, heralding the advent of dynamic principles of elucidation, the philosopher looks upon body and all organic processes alike as manifestations of purposive forces, the sum-total of which, viewed as vital force, constitutes the soul immanent in the organism.

The influence of this upon the organism in general is that of a particular species of function, not as soul (*εἶδος, ἐντελέχεια*) in general, but always either as nourishing, perceiving, moving, or thinking, or as several of these together. With exception of the spirit (*νοῦς*), a "portion" of the soul peculiar to man, united to no bodily organ, the functions of the soul, movement, desire, perception, have their centre in the heart. This is the original source of the blood which, vitalised by inherent warmth and pneuma, constitutes a bond between body parts and the seat of the soul. Its position and the fact that it is the first part of the embryo to be formed and the part which death overtakes last, indicate the importance of the heart as the chief seat of life. The brain, cold, bloodless, insensible, is the opposite to the heart, its only function being to compensate the warmth arising from the heart. By means of "coction" the heart-warmth prepares blood free from nutriment, and brings it to ebullition, which is manifested in pulsation. At the same time warmth produces distension of the lungs which, like bellows, take up air and are able to transmit it through veins to the heart in order to cool the latter, by which means excessive accumulation of warmth is guarded against. Hence it is that warm-blooded animals breathe the most deeply. The blood, kept fluid by warmth, flows through the vessels, pulsating synchronously with the heart, to all parts, which are watered as a garden by brooks which continually subdivide. The purest blood supplies flesh and organs of sense, the crudest bones, hair and like structures. Darker and thicker blood, serving for nourishment and growth of organs, circulates mainly in the lower parts of the body; thinner and colder blood, adapted to the transmission of sensation, in the upper, where therefore the sense organs are situate. Nourishment taken into the stomach undergoes "coction" under the influence of warmth and pneuma, and from the intestine, after voidance of excrementitious materials, it reaches the mesenteric vessels to be conducted to the heart by way of the great vessels as *ἰχώρ* (chyle), there to be converted into blood.

Concerning the abdominal organs the intestine is of such length in order that food may

not pass through too rapidly; liver and spleen serve to fix the vessels and assist digestion through their warmth; the spleen draws unnecessary moisture from the stomach; the liver has the gall-bladder attached to it, which contains a useless excretion, bile.

The diaphragm serves to separate the nobler organs of the chest from exhalations rising from below. Voice originates in the larynx through the inspired air coming into contact with the walls and causing them to vibrate.

The embryo is a product of warm male semen (a mixture of fire and water), which contains the soul, and the female catamenia.

Of the Aristotelian pathology—*περὶ δὲ ὑγείας καὶ νόσου, οὐ μόνον ἔστιν ἱατροῦ, ἀλλὰ καὶ φυσικοῦ μέχρι τοῦ τὰς αἰτίας εἰπεῖν*—traces only are in existence, which show the victorious career of humoral doctrines. Thus the philosopher explained pleuritis as a coction or thickening of fluid portions. The medical writings have unfortunately been lost; the pseudo-Aristotelian *προβλήματα* date from the Alexandrian era and were an anonymous compilation from two books of “medical problems” and from the Hippocratic Collection.

The peripatetic school followed in the master’s footsteps and many of its principal representatives accomplished much in the domain of natural science, particularly the immediate successors of Aristotle: Theophrastos of Eresos, who extended the method to botany and mineralogy and also wrote upon problems in physics; the physicist Strato of Lampsacos; also Eudemos of Rhodes, and Phantias. Of great importance to medicine were, besides exemplary botanical and pharmacological works, many lost writings of Theophrastos and Strato, the osteology of Clearchos of Soloi, the anatomy of Callisthenes of Olynthos and the historical compilation of Menon.

Although the influence of Aristotle only became all-powerful amongst the Arabs and in the era of scholasticism, some of the fundamental traits of his methods of research and of thought make themselves felt at least suggestively in the later development of Greek medicine, when this was transplanted to foreign soil after the loss of freedom of the mother-land.

The feeling for genuine critical observation of nature, in association with scientific logical and dialectical construction, and for historical investigation impressed itself upon the most noteworthy achievements of later times.

MEDICINE OF THE ALEXANDRIAN ERA

THE dogmatic school, in its prime partly contemporaneous with the decline of Hellenic freedom and with the Macedonian hegemony, and characterised by its leaning towards science as foundation for medicine, was perpetuated in the subsequent historical era which includes the age of the Diadochi. This continuation, however, was effected with vastly better accessories, upon a far wider basis.

In addition to the intrinsic evolutionary process which, on account of the manifold disappointments it encountered, naturally called forth an opposing retrogressive, empirical movement, many extrinsic influences made themselves felt at this time. These influences altered, to a certain extent, the range and conduct of inquiry, so that a specific developmental period of Greek medicine may suitably be spoken of which, from its most important seat, is called the Alexandrian.

It is strong evidence of the radical change which conditions had undergone that this newly-founded emporium of the land of the Pharaohs had now, in place of Cnidos and Cos, taken its position as the pioneer city of Greek medicine, and the fact heralded the dawn of a mission which was to extend far beyond the boundaries of the mother-land.

Transference of the headquarters of medical science abroad to the residence of the Ptolemies, where Hellenic influences were rife, and whence cultural impulses radiated, was only one event of many which, taken together, constituted that historic upheaval through which, borne by Macedonian arms, Greek speech, customs and civilisation spread east and south. A way was thus paved for the identification of hither Asia and Egypt with Hellenism, whilst Greece herself on the one hand gained a wealth of knowledge, on the other became gradually denationalised.

Medicine in the Alexandrian era, dependent upon the widespread and general cultural movement which emanated from Hellas after the loss of Greek political independence, bears characteristics identical with those of Hellenic culture as a whole. The same factors which otherwise influenced the intellectual life of this epoch, now in restraint, now as a stimulus, have a decided bearing upon the evolution of its medicine.

A happy coincidence of the realistic intellectual tendency, raised to its greatest height by Aristotle (even appearing in the art of a Lysippos and an Apelles), with the warlike successes of Alexander the Great, laid the foundation of Hellenistic culture and from the first marked out for it a definite path. If this culture owes to the hero-king revelation of many things in nature hitherto unsuspected and of an ancient and unfamiliar intellectual world, it was nevertheless the methods of the Stagirite which made possible the elaboration of this ever-increasing sum of knowledge into profitable form. A widening mental horizon awoke in Hellenism a striving after expansion of its own being—a sequence of the compilation and critical investigation of precedent achievements; further, a stimulus was given to the task of elaborating the new material—whereby the technique of scientific investigation received fresh impulses—and finally to the endeavour, arising from the mixture of races under the Diadochi, to produce a homogeneous civilisation, by means of adaptation, assimilation and coalescence. An illustration of this upheaval is to be found in the language of the Hellenistic epoch which, under increasing influences of half-Greek or wholly foreign origin, was moulded on the Attic tongue and bore to it the same relationship that cosmopolitanism bore to nationalism.

Exaggerated erudition, realism, technical dexterity in the arts—these strike the keynote of the age. Favoured by the protection and encouragement of the great—not on the soil of a free country—those arts and sciences flourished exceedingly which serve practical ends or whose goal is attainable by such talents as fall short of the highest order on the lines of collation and collaboration, if only the great thought of a master-thinker is added to serve as a mainspring of action. Such subjects are mathematics, astronomy, physics, the descriptive natural sciences, technical arts and architecture, geography and periegesis, the theory of art and history of literature and, in particular, philology. In those realms, on the other hand, where independent thought, high ideals, unfettered imagination, or the profound speculations of genius with powers unwearied by analytical specialisation are alone capable of producing original creations, as in poetry, in constructive art, in philosophy, in these (with notable individual exceptions) the achievements of this epoch show barren mediocrity and feeble ill-development. This age, with the refined artificiality of its eclectic philosophers and erudite poetasters, with its affected naturalistic sculpture and painting, only serves as a vivid reminder that the classical epoch of an æsthetic Greece, with its profound originality, was already a thing of the past.

Medicine in the Alexandrian era, the evident product of prevailing conditions mostly favourable to it, made great advances, not only in the sum-total of practical knowledge and methods of healing, but also from the point of view of the scientific attitude of thought, which was, however, only too soon permeated by soaring speculation and sharp-witted dialectic.

Alexandria, the new seat of learning, had at its disposal all means and appliances with which to advance the traditions of Cnidos and Cos along the lines of systematic investigation laid down by Aristotle. Here well-stored libraries facilitated research into literary and historical sources (the centre of interest being the *Corpus Hippocraticum*). Here masters of many-sided learning, surrounded by an international school—Greek, Egyptian, Jewish—put their knowledge to the test upon a crowd of patients, attracted from all parts—some with complaints hitherto unknown. Here trade brought an immense variety of new medicaments upon the market, and, when it was sought to systematise the growing mass of knowledge, to sift it, or by thought to shed light upon it, nowhere were exponents more easily found than in the strenuous intellectual life of Alexandria, where the flourishing state of descriptive and exegetical science afforded sure help.

The collection of medical manuscripts together with the study of medical literature and history, the encouragement of zoology, botany and mineralogy, the introduction of discoveries in technics and physics into the service of medicine, the foundation of a form of ambulatory clinic in the Museion all bore rich fruit in the verification of and inquiry into scientific tradition. The same influence was also exerted upon pharmacology and toxicology, upon refinement of symptomatology and diagnosis, upon surgical appliances and dressings, whilst undoubtedly medical theory itself gained much from the quantitative mode of thought borrowed from the physicists, as well as from the already familiar experimental method.

What had previously been achieved only sporadically and under the greatest difficulties and had been lost owing to lack of centralisation of scientific pursuits, now flowed in a broad stream into a common reservoir.

The most striking advance, however, was made in anatomy, which first and perhaps exclusively received in Alexandria that unprejudiced assistance necessary to its progress. Its way paved by the custom of embalming, whereby human dissection was not in Egypt, as elsewhere, hampered by the odium of impiety, favoured by the active interest of the Ptolemies anatomy passed from zootomy to dissection of the human body; from scattered, accidental, isolated discoveries to preparation of

specimens and to systematic investigation. Thus was accumulated a mass of material that, developed into an independent science, provided opportunity for the boldest and most successful operations, particularly in surgery and obstetrics. Although the period of full flower of the art of dissection, with its complement, vivisection, was a short one—as early as in the time of Ptolemy Physkon many scholars and physicians were expelled—yet its after-effects made themselves in so far felt that for centuries medical education was nowhere so intimately connected with anatomical knowledge as in Alexandria.

According to the reports of Celsus, the Ptolemies even gave permission to perform vivisection upon criminals “in order to study during life the position, colour, shape, size, arrangement, hardness, softness, smoothness, outer surface, as well as the prominences and curves of the individual organs.” It was maintained by opponents of this horror “that it not only brought discredit upon the art of healing, but was superfluous, since a human being, after the abdomen was opened, the diaphragm divided, and thorax entered, died before scientific investigation could be undertaken.” These statements, from which the sequence usually followed in section may be deduced, find no support anywhere in Galen (who is the most notable authority upon Alexandrian anatomy), but only from the father of the Church, Tertullian, and are perhaps to be placed on a level with a tale according to which the painter Parrhasios utilised as model a martyred slave in order naturally to represent his Prometheus with the expression of greatest possible human agony.

Pliny relates that the Egyptian kings, in their zeal for knowledge, occasionally took part in cadaveric sections with their own hands. The great use that art in the Alexandrian era made of advances in anatomical knowledge is proved by the surprising truth to nature of objects excavated at Pergamos.

Anatomy had unfortunately no influence upon medical theory in the sense of furnishing it with a genuine foundation—at most the anatomical localisation of many symptom-complexes with which the Cnidian school had begun were increased in number. Physiology and pathology remained a free field for speculation, and dogmatism gained in strength from extended anatomical knowledge which, at times in harmony with existing physical conceptions, was utilised with great ingenuity to rehabilitate discredited doctrines and, to the detriment of therapeutics, conveyed a transient and deceptive appearance of exactitude. Once more did bombastic plausibility and craziness flaunting as erudition win the day against the homely truth of plain hands and honest eyes.

The great pioneers in anatomy, the acute observers by the bedside mostly had disciples who looked upon the technical achievements of their masters less as indications for further research guided by experience, than as the starting-point of subtle speculations upon life in health and disease. Book-learning and polymathy led them in the footsteps of the Alexandrian librarians and grammarians to see in hypercritical commentary and exegesis end rather than means, whilst a mania for system, premature and over-

confident, led them, overlooking the radical difference in objective, to introduce into medicine the abstract deductions of the mathematician and the subtle hair-splitting dialectics of the philosopher.

Thus the medical scholastics became more and more strangers to quickening experience and, lost in the idle wranglings of the schools, they divorced theory from its proper source—the practical art of healing with its informing and ever-changing pictures. Too long the plaything of scholastic disputations or pushed aside as a negligible quantity by aspiring pseudo-science and left to chance, therapeutics lost their true inherent connection with the dogmatic school and were, by a new medical sect, the empirics, considered an independent branch of knowledge and were supported by dispassionate, sober observation.

However justified the reaction of this sect against the empty pseudo-science of the dogmatists may have been, however lasting may be their services towards the furtherance of the art of healing—the empirics nevertheless mistook the true spirit of Hippocratism even whilst invoking it. From the first they rejected with absolute scepticism the dawning possibility of a reconciliation between theory and practice, which alone should justify the rational attempt to establish a scientific theory, and strove to choke the germinating seed of anatomico-physiological investigation with the weeds of speculation.

Given up to an uncritical “experience” which threw wide the portals of medicine to oriental superstition, the later adherents, at any rate, of the empiric sect initiated the relapse of the art of medicine back into the crude earlier stages of its development.

This aspect of Alexandrian medicine is only a phase of the general culture of this age of upheaval when osmotic interchange between East and West brought exact thought into violent contrast with the profoundest superstition and when fantastic mysticism appeared as a sequel of heedless scepticism.

HEROPHILOS, ERASISTRATOS AND THEIR ADHERENTS

THE significance of the Alexandrian era in the progress of scientific medicine can, from the almost total loss of contemporary medical literature, be only indirectly inferred—from the comments of later authors, from the after-effects constantly manifested in subsequent development.

We possess only very fragmentary information upon the individual attainments of the investigators with whose names such attainments are linked, but behind the veiling mists of centuries at least the main trend, the aim and methods of Alexandrian medicine can be made out, also with some distinctness the forms of two leaders whose forceful example opened up new paths. Two investigators, who so moulded the inherited traditions of Cnidos and Cos into conformity with new conditions as to give rise to new schools, stand out above all others as kings above cowherds—Herophilos and Erasistratos. All traces lead back to these two.

Herophilos of Chalcedon (ca. 300 B.C.), a pupil of Praxagoras and Chrysippos, one of the most celebrated physicians of antiquity, investigator and practitioner of enduring fame, pursued his activities under the two first Ptolemies in Alexandria, the medical renown of which city owes its foundation largely to him. Of his numerous works unfortunately only a few fragments have survived.

Uniting the feeling for isolated facts typical of the Cnidian school harmoniously with the broad medical principles of the Coan, inclined to new things without despising the work of his predecessors, Herophilos understood equally well how powerfully to further the interests of the auxiliary sciences and fruitfully to develop practical medicine in all its branches in accordance with experience and unbiassed by premature striving after a system. Full of reverence for his profession he upheld its influence upon the progress of civilisation by the statement that, without health, no achievements could be attained in any domain. He strove on the one hand to amplify and to substantiate clinical experience by exact method and, on the other, holding aloof from ephemeral speculation, he clung faithfully to the principles of Hippocrates.

He improved the technique and developed the terminology of anatomy

and enriched it by valuable discoveries made in the dissection of human bodies, particularly in the knowledge of nerves, vessels and viscera, but also in that of the eye. With his works systematic anatomical investigation may in fact be said to begin.

He described the meninges, ventricles, blood-sinuses and choroidal plexus of the brain, in the cavities of which (particularly the fourth ventricle) he placed the soul; the calamus scriptorius (κάλαμος Ἡροφίλου) and Torcular Herophili are still by their names reminiscent of the gifted Alexandrian brain anatomist. He distinguished nerves from tendons (as a different form of the same tissue), followed them in their course from brain to spinal cord and recognised them as implements of will power and sensation.

The excellently described optic nerves he still designated πῶρος, duct (for the Pneuma), yet he knew the vitreous humour and three coats of the eye, the "horny," the "shaggy" and the "reticular."

With great care he described the coarser relationships of the vascular system and distinguished the blood-conducting veins from the arteries, filled with blood and pneuma, which arise from the heart and possess coats six times as strong. The arteries of the lung, differing from all others in structure, he named φλέψ ἀρτηριώδης; of the mesenteric veins passing into the portal fissure he already distinguished those vessels "which come from the gut and enter certain gland-like bodies," i.e. he recognised the lacteals. Herophilos gave the duodenum its name (δωδεκαδάκτολος), carefully described the liver, instituted comparative researches (into the livers of certain mammals, variations in shape and position), described the salivary glands, the pancreas and, most excellently, the genital tracts of both sexes. The results of his investigations he embodied in a work of at least three books, with one specially devoted to the eye.

In the physiology of Herophilos dynamic views prevail (under the influence of the peripatetics) but already a certain tendency towards physical explanations is shown. Four forces govern the operations of the organism: those of nourishing, warming, perceiving and thinking, with respective seats in the liver, heart, nerves and brain.

As a pathologist Herophilos laid chief stress upon evidence of the senses, upon thoughtful observation, and gave experience precedence over theoretical speculation (λογικὴ μέθοδος). Thus he did not so much seek fundamental causes of disease as give his adherence in general to the traditional humoral pathology only because there was as yet nothing better wherewith to replace it, and he scorned the establishment of definite theorems upon the humoral origin of individual complaints. Symptoms on the other hand formed the constant object of his attention, from these he sought to establish pictures of disease, to deduce diagnosis and prognosis.

Amongst symptoms those which influenced him most were pulse phenomena, and he fully grasped their significance as a gauge of the general condition of the body.

With admirable care he studied the varying character of the pulse—the clepsydra serving him for measure of time—under different conditions

(time of life, various diseases), as to size, strength, rate, rhythm, and according to regularity, uniformity, or their opposites he distinguished different characteristic varieties (*e.g.* the bounding pulse, σφυγμὸς δορκαδίζων).

Attracted by the highly developed musical theories of his age Herophilos, with over-elaborated subtlety, drew analogies from the doctrine of rhythm, taking into consideration not only systole and diastole, but also intervening pauses (intervals), making four phases in all. Upon this foundation he built up a pulse-lore which, from its too fine-spun theoretical assumptions, was bound to find more admirers than practical adherents.

Herophilos was also author of commentaries upon the Hippocratic writings, dealing chiefly with semeiosis and prognosis; the book *περὶ αἰτίων* deals with general pathology wherein are perhaps included the results of investigation by dissection.

From extracts we can see that, like his master Praxagoras, he had the temerity indulgently to correct the sage of Cos upon the ground of his own experience, and with keen clinical insight he discovered many new facts.

Sudden death without obvious cause he put down to heart weakness; twitching and cramp to muscle and nerve affections, paralysis to lack of nerve-force; finally he observed that sometimes sensation only, sometimes voluntary movement, sometimes both are interfered with. The passage of dead worms he did not look upon as of evil prognosis; of opisthotonos he said that it could bring about straightening of spinal curvatures; he warned against inconsiderate extraction for toothache, since he had seen it followed by death.

Herophilos was not content with the rôle of scientific inquirer, he strove for equal distinction in practice (*τέλειός ἐστιν ἰατρός ὁ ἐν θεωρίᾳ καὶ πράξει ἀπηρτισμένος*) and conceded theories no influence upon therapeutics. He wrote an independent work upon "Cures" based upon experiment and strictly empirical observations. Although in general following the therapeutic principles of the Hippocratists he departed from the simple Coan methods of treatment, where few drugs were employed, making use of all kinds of medicaments in every affection, particularly vegetable or compound drugs. The wealth of materials from the three natural kingdoms brought together by international intercourse awakened the desire for investigation. The luxurious life of the age for which, in times of sickness, simple dietetic prescriptions no longer sufficed, predisposed to the vogue of extravagant polypharmacy. In addition to drugs, which he poetically called "hands of the Gods," Herophilos made free use of blood-letting; in hæmorrhage, following Chrysippos, he practised bandaging of the limbs; in hæmoptysis he gave salted articles with bread and water. Dietetics (upon which he wrote a separate work) and gymnastics, upon which subject he was also one of the greatest authorities, completed the means of cure.

The profound anatomical knowledge he had at his disposal enabled

him to accomplish much in surgery and obstetrics, which latter subject he also taught. The rich experience which Herophilos had amassed upon the whole range of the healing art, the happy mental attitude which enabled him to reconcile his leaning towards the new with adherence to the old, translated his speculations beyond the confines of medicine and raised them to the summit of enlightened, mature worldly wisdom. This is reflected in the incisive phrase which he has bequeathed as a testament to all the future race of physicians: "The most perfect physician is he who distinguishes between the possible and the impossible."

Herophilos wrote upon obstetrics the *μαιωτικόν*, i.e. the midwives' book, which, even after the lapse of centuries, met with favourable recognition.

He mentioned as causes of difficulty in delivery, mal-position, narrowness of the cervix or os, thickening of the membranes, and retention of the liquor amnii, weakness of the uterus or os, general weakness, hæmorrhage, death of the fœtus etc. Delivery could occasionally, but with difficulty, occur without rupture of the membranes. In prolapse only the os uteri descended. Concerning teaching of obstetrics there is a story of Agnodice who, dressed as a man, was taught by Herophilos, and subsequently in contravention of the law, which forbade the exercise of the profession to women, practised as a physician in Athens and upon a complaint from her male colleagues was taken before the Areopagus, but acquitted.

Concerning surgery it may be mentioned that Herophilos considered dislocation of the hip, with rupture of the ligamentum teres, as incurable.

Erasistratos of Julis (on the island of Ceos) not only ranks equally with Herophilos in positive achievements, but acquires a peculiar interest through the fact that he stands as the most prominent representative of the "exact" tendency, towards which the Italian and Cnidian schools strove, but which acquired a firmer foundation in the Alexandrian era.

Erasistratos was probably born about 330 B.C., a son of the physician Cleombrotos and of Cretoxene (sister of the anatomist Medios), and received his medical training mostly from Metrodoros, a pupil of Chrysippos of Cnidos (and third husband to Pythias, daughter of Aristotle).

Through extended travel and diligent study he acquired a wide culture, in proof of which may be adduced his familiarity with Homer, the influence upon him of peripatetic philosophy (Theophrastos) and his profound knowledge of the Hippocratic writings.

It is doubtful where Erasistratos carried out his anatomical investigations and which was the actual scene of his activities as a founder of a school of his own. His presumed sojourn in Alexandria is rendered probable by many veiled references to the court of the Ptolemies and by the admittedly negative fact that the possibility of obtaining human corpses is not proved to have existed elsewhere. That he previously held the position of court-physician to the Seleucidæ at Antioch, for a time at least, is indicated by the well-known romantic tale, glorified also in art, of the love-sick son of Seleucus Nicator Antiochus. The tale runs that Erasistratos recognised as the cause of the prince's severe illness his secret love for his stepmother Stratonice, and was able by a cunning stratagem to induce the king with self-abnegation to fall in with his son's wishes. The greatest anatomical discoveries were made by Erasistratos only in his later years, when he probably gave himself up exclusively to scientific research.

He died about 250-240; as he was buried by the headland of Mycale it was assumed that he withdrew at the end of his life to Samos (opposite Mycale). His death was voluntary; he took poison on account of an incurable ulcer. His last words, "It is well that I should remember my country," are to be understood in the light of the fact that in Ceos the suicide of old men was no uncommon thing—a survival from the barbaric custom of killing the aged.

The writings of Erasistratos, which even in Galen's time were incomplete, deal, as may be gathered from quotations, with "general principles" (including physiology, anatomy, ætiology, hygiene, food and drugs, toxicology), and important chapters upon special pathology and therapeutics, written in monograph form, such as varieties of fever and their treatment, abdominal affections, paralyses, podagra, dropsy, etc.

Like Herophilos Erasistratos made a successful study of anatomy, even surpassing the former in knowledge of details, and in a series of observations upon the cadavers of men and animals corrected his own mistakes as well as those of others. His greatest achievement was in the study of nerves and vessels. At first confusing vessels with nerves and considering them as arising from the dura-mater, he later asserted that the nerves were filled with marrow, sprang from the brain-substance itself and were to be divided into those of movement and sensation. The difference in structure between cerebrum and cerebellum did not escape him, nor the difference between the brain of man and animals in richness of convolutions, the significance of which he noted. The seat of the soul he placed at first in the meninges, later however in the cerebellum (the fatal result of injury to this was deduced from observations upon animals).

The description of the heart with its valves and chordæ tendinæ he brought to perfection, teaching that the arteries (containing pneuma) had their origin in the heart; the lacteals (in goats) he observed, but took them for arteries containing, sometimes air, sometimes milk.

He gave the trachea its name and knew that the function of the epiglottis was to close it. Of the viscera he described the liver with particular care and distinguished the bile-ducts. Pathology also derived benefit from the dissections of Erasistratos. He found, for instance, that in dropsical patients the liver was hard like a stone; that as a result of poisoning from snake-bite (of a special kind) liver, large intestine and bladder became softened; deduced from results of post-mortem examinations the seat of disease in pleuritis and recognised as an outcome of pleuritic exudation, effusion into the heart—certainly remarkable commencements of anatomical thought.

The physiology of Erasistratos is characterised by the fact that he pursued to their ultimate conclusions a series of earlier doctrines, such as the pneumatic, and elaborated them generally and individually from a mechanical point of view by invoking the physical axiom of the horror vacui (*πρὸς τὸ κενούμενον ἀκολουθία*). The basis for this is formed by the traditions of the Italian and Cnidian schools (physical comparisons are repeatedly met with in the Hippocratic writings), and by contemporary physics, whilst an attractive model existed in the theorems of the peripatetics (particularly Strato) and of the stoics.

Erasistratos considered the body, compounded of atoms, to be vivified by warmth added from outside, not inherent. The foundation of organic energy he held, neglecting the four-element theory, to be on the one hand blood, which is propelled exclusively through the veins, on the other pneuma, which is the energy carrier and dominates all vital phenomena. Renovation of the pneuma is brought about through respiration, whereby air penetrates into the left side of the heart through the pulmonary vein. Thus two varieties of pneuma result of which one (the vital pneuma, π. ζωτικόν), is propelled into the arteries, its function being to regulate vegetative processes throughout the body; whilst the other (soul-pneuma, π. ψυχικόν) has the brain as its goal, whence it effects movement and sensation by way of the nervous system.

Blood is a conversion product of ingested nourishment and serves to build up the body; its distribution gives rise to the proper substance—parenchyma (fr. παρεγγέω)—of certain organs (liver, lungs, spleen, kidneys and brain, but not stomach, intestines, bladder and uterus, *i.e.* viscera of fibrous structure). From the liver, where blood first comes into existence, it is conducted into the venæ cavæ and is distributed by way of the venous system. The lungs receive the blood supply from the right ventricle through the pulmonary artery, the alternating valvular action in which acts as regulator of the circulatory mechanism.

At the moment of systole the semilunar valves open, whilst closure of the tricuspid hinders regurgitation. Arteries and veins stand anatomically in relationship through the ultimate venous ramifications opening into the arterial terminations. These “Synanastomoses” remain, under physiological conditions, closed; in pathological conditions, however, or when an artery is cut, blood may penetrate into the pneumatic circulation (παρέμτωσις). Hæmorrhage from wounded arteries occurs through pneuma first escaping, following which, in obedience to the law of horror vacui, blood at once flows out of the veins into the arteries so that no empty space may ensue. Escaping blood therefore does not come from the arteries themselves, but only through them by the connecting link of the synanastomoses).

Movement follows upon the hollow spaces of muscles being respectively filled and emptied with pneuma; respiration by passive entry of air, which was supposed to possess a certain density, into the voluntarily distended chest; digestion is a mechanical trituration of food through changing pressure of the walls of the stomach under the influence of pneuma. Nourishment and growth are brought about, as is also secretion, according to the law of horror vacui.

In separation of bile from blood, the diameter of vessels comes into consideration, for the narrow biliary ducts in the liver allow only the thin bile to pass, not viscous blood.

Erasistratos attempted to prove the existence of insensible excretion by starving an animal (a bird) for a while, and tried to prove a loss of weight not accounted for by visible excretions.

The consequence of his mechanical mode of thought was that Erasistratos—particularly in opposition to the peripatetics—denied the existence of specific forces (notably the active powers of attraction of organs in their function and nourishment).

He also recognised in general—like the Hippocratists and especially the stoics among philosophers—the purposeful scheme of nature, but held that many useless parts existed in the body, such as spleen, bile, etc.

It was doubtless distinctly detrimental to future scientific development that he—distinguishing between physician and investigator—declared a knowledge of the more minute physiological details to be of no value to medicine, *e.g.* how food is digested, how humours are derived from it, etc. Relegation of such questions to pure science threw those amongst his successors less imbued with a thirst for knowledge into the arms of empiricism.

Under the influence of an anatomical bias and of a mechanical conception of nature, Erasistratos attempted also to free pathology from the bonds of traditional humoral theory and to build it up from a few simple principles.

This strictly scientific tendency impelled him, in view of the yet small content of anatomico-physiological knowledge, to put aside or even to oppose much that seemed clinically established but of which at that time no causal explanation was forthcoming.

Such were the doctrine of the remote origin of disease and the established significance of prognostic (critical) signs, also ætiology and semeiosis, upon which Hippocrates had laid so much weight. Carried away by his convictions he did not hesitate at contradiction of the older master of clinical observation and frequently gave expression to the same in a manner characterised by Galen as *φιλονεικία* or *κακοηθεία*. He broke entirely with traditional humoral pathology, the more so that dissection had taught him to think in terms of anatomy and more and more to look to the solid parts of the body as seats of disease.

Erasistratos, looking upon disease as essentially a disturbance of normal physiological functions, directed his chief attention towards the careful investigation of symptoms, *i.e.* of functional disturbances, seeking to establish their exciting causes as well as the seat of the mischief. This method which, seeing its end, steadfastly pursued it, led to analysis of individual cases under particular conditions and with due consideration of the incidence of disease.

Starting from the premise that the normal course of physiological functions is dependent upon accurate filling of vessels (of veins with blood, of arteries with pneuma) and unhindered movement of pneuma, Erasistratos explained the most frequent cause of pathological manifestations as the overfilling of vessels with alimentary matter—plethora. This gives rise, in an ascending scale, to distension of the walls of the veins, later to rupture of the same, then to forcible penetration of blood, by way of the synan-

astomoses, into the arteries (with consequent impediment to the action of the *pneuma*). Thus disturbance of digestion occurs through plethoric obstruction to alteration in size of the stomach; arthritis through plethora of joints; inflammation through error loci with penetration of blood into the arterial terminations.

Fever is not an independent affection, but always a symptom of some inflammation, in the course of which fever arises through the presence of blood in the large arteries, obstruction to movement of the *pneuma*, and sympathetic disturbance of the heart. Inflammation and fever, according to this view, originate through the same mechanism (varying only in intensity) and show abnormal pneumatic movement by a tumultuous pulse (*σφυγμός*).

Erasistratos attached little importance to investigation into disease origins, since unfavourable external influences and mode of life do not always give rise to disease; his standpoint in relation to humoral pathology was one of active disagreement, whereas Herophilos took up a neutral attitude. Most diseases were ascribed by him ultimately to excess of nutriment and its undigested residue, which formed the basis for plethora. The result of this was, according to its extent or situation, fatigue, ulcers, hæmorrhoids, hæmoptysis, etc., and as a consequence of passage of blood into the arteries, manifold inflammations, *e.g.* angina, inflammation of the lungs, pleurisy etc. Fever occurs in various primary diseases and is characterised by rise in temperature, frequency of pulse, "purulent" deposit in the urine. In contrast with Herophilos Erasistratos laid little stress upon examination of the pulse, which may be explained by his assumption that arteries contain only *pneuma*. Paralyses occur through error loci, phlegm (as a result of obstruction in the brain) penetrating the neural arteries and interfering with the pneumatic circulation.

Dropsy is a result of hepatic affections, the circulation of blood being thereby impeded and the unpurified blood being poured into the abdominal cavity as a watery exudate.

Topical diagnosis was extended by Erasistratos to a bold topical therapy, thus he went so far as to open the abdomen in hepatic disorders so as to apply medicaments directly.

As a consistent thinker Erasistratos strove so far as possible to plan his treatment ætiologically, to simplify it and, in addition, always to individualise—principles standing in sharp contrast with the polypharmacy of the age, which made use of routine mixtures of most complicated nature.

It is a striking fact, but comprehensible in view of the traditions of his teacher Chrysippos on one hand, and on the other of the above outlined theory of disease, that Erasistratos had a great dislike of venesection. He based his very strict limitation of this measure not only upon experience but upon the contention that venesection, *e.g.* in inflammations, not only left untouched the real pathogenic cause (excess and perversion of nourishment) but also did not prevent penetration of blood into the arteries and disturbance of pneumatic movement. He also maintained that it was impossible to determine beforehand the amount of blood it was

necessary to abstract. As with blood-letting, he largely restricted the use of purgatives, since they were injurious to the humours.

Seldom employing either method, he first and foremost regulated the diet, his directions including most minute details and, individualising with care, he enjoined rest or movement, bodily exercises, fasting, baths, friction, cleansings, in suitable cases mild purgatives, enemata, emetics, diuretics or diaphoretics. In place of venesection his practice was to wrap up the limbs (shoulders, arms, hips, thighs *e.g.* in hæmorrhage or hæmoptysis, upon the supposition that the synanastomoses thus would be closed), or to use local applications (leeches, cautery, poultices etc.). In treatment of fever he returned to the simple dietetic and hygienic measures (including infusions) of Hippocrates and sought to prevent loss of strength by plentiful nourishment, later also with wine.

Of the surgery and obstetrics of Erasistratos little trace remains (discovery of the S-shaped catheter ; extraction of the dead foetus by means of a hook-shaped knife).

“ He who would heal successfully must acquire practice in such matters as pertain to medical art, and must leave no symptom uninvestigated that accompanies the disease, but must search for it and must seek to discover what manner of disposition accompanies each separate ailment ”—in these words did the master enunciate his confession of faith.

Upon the development of the art of healing he exercised a powerful and in many respects a determining influence ; even in later times the trend of medical thought has come into line with his lucid views.

In addition to the two founders of Alexandrian medicine, Eudemos was noted as an excellent anatomist ; he studied with great success nerves, vessels and glands (pancreas), and enriched osteology by many accurate descriptions.

The pupils and later adherents of Herophilos and Erasistratos formed separate sects, which for centuries clung fast to the masters' principles, and sought to extend the healing art along their lines. The fulfilment, however, only partly corresponded to the fair promise.

Practical knowledge, it is true, received important additions, particularly in surgery, obstetrics and materia medica, but scientific investigation and thoughtful observation of disease-manifestations were little advanced. Indeed they sank gradually into a stagnant condition, the unbiassed, critical, pioneering spirit of true science being lost in a barren adherence to scholastic dogmas, in subtle sophistical defence of these, and in useless definitions. Of the achievements and teachings of Herophilos and Erasistratos only the empty husk survived them.

The followers of Herophilos recognised the necessity of anatomy, but for the most part were content with inherited knowledge, adding nothing to this by new discoveries. Examination of the pulse certainly served as the basis of diagnosis, but pulse-lore assumed so complex a form through arbitrary distinctions that its utility in practice had infallibly to suffer. The Herophileans, on the other hand, worked in praiseworthy fashion at the questions of prognosis and of treatment, guided here by experience and following in the footsteps of Hippocrates, whose works were esteemed as highly as those of their own master and diligently annotated.

The Herophilean school flourished in Alexandria until the expulsion of the scholars under Ptolemy Physkon, and about the middle of the first century B.C. received a second impulse in a new centre, Laodicea, a town on the Phrygian-Carian border connected by trade with Alexandria. Amongst the older Herophileans stand out Bakcheios of Tanagra, as expounder of the Hippocratic writings and elaborator of pulse-lore; Manteas as pharmacologist, surgeon and gynæcologist; Demetrios of Apameia, as clinical observer and renowned obstetrician; Heracleides of Erythræ as commentator of the "Epidemic diseases" of Hippocrates, and Andreas of Carystos, as the author of an excellent work upon *materia medica*.

The second Herophilean school owes its renown to the younger Zeuxis and to Alexander Philalethes (A.D. 1), the latter being celebrated, not only for his work as a gynæcologist and for his pulse-definitions, but also as the author of a treatise upon the doctrinal opinions of physicians (*Ἀρέσκοντα τοῖς ἰατροῖς*) which was the writing mainly drawn upon by the author of "Anonymus Londoniensis."

To the later Herophileans belong Dioscurides Phakas (court physician to Cleopatra, author of twenty-four important works, amongst which is one upon the plague; the name Phakas comes from *φάκος*, a lenticular spot on the face); Apollonios Mys (a celebrated pharmacologist); Demosthenes Philalethes of Massilia (the most celebrated ophthalmologist of antiquity, possibly also the author of a work upon pediatrics) and the ophthalmologist Gaius of Neapolis.

The history of the Herophilean school, which came to an end in the course of the first century A.D., has been several times transcribed by adherents, as by Bakcheios, Heracleidos, Apollonios Mys and Aristoxenos (pupils of Alexander Philalethes).

The Erasistrateans only won recognition as an independent sect much later in comparison with the Herophileans, but maintained their position until the second century A.D. Although they held the scientific development of medicine as a postulate, nevertheless the majority of them con-

sidered it sufficient to adhere to the incontrovertible axioms of Erasistratos, whom they revered as a god. With few exceptions, especially in later times, they hardly attempted to develop anatomy or even physiology, the latter subject being considered as the domain of the scientific investigator, not however of the physician. Despising the achievements and opinions of all others, in particular those of the Hippocratists, always contentious, they lived in incessant feud with other sects and considered the doctrine of *plethora* and *error loci* as the sum and substance of pathology. With the exception of a few noteworthy achievements their therapeutics sank to an unintelligent routine although they kept up a pretence of science. They were insistent in forbidding venesection, of which they had as great a horror as of poison.

A prominent position is occupied by the Erasistratean Strato, who raised the restriction of venesection to the level of actual prohibition, wrote upon leprosy (*elephantiasis*), and distinguished himself as a gynæcologist; also by Apollophanes of Seleucia, court physician to Antiochus the Great, he wrote a book upon poisonous animals; by Apollonios of Memphis (writer upon pulse-lore, surgery, ophthalmology and poisonous animals); by Ptolomaïos (about 150 A.D. in Alexandria, who worked upon the subject of optics); lastly by the anatomist Martianos (or Martialis).

The school of Erasistrateans reached its highest point under the two friends Hikesios of Smyrna and Menodoros; the former was the author of a long esteemed work upon drugs and diet.

THE SCHOOL OF EMPIRICS

SURGEONS AND PHARMACOLOGISTS OF THE ALEXANDRIAN ERA

IN sharp contrast with the followers of Herophilos and Erasistratos there arose in Alexandria a third school—the empiric—which, weary of transcendental and contradictory speculation, directed its energies solely upon the practical aims of medicine through the medium of observation and experience. The impulse leading to the foundation of this school, which adopted the name of no founder, but was called after the tendency of its research, was derived on the one side from the scholastic wranglings of the dogmatists, who frittered away their best powers in fruitless hypotheses or subtle definitions and in a chimerical physiology and pathology: on the other it arose from the revelation that the young science of anatomy by no means brought with it those results the immediate influence of which upon medical practice had been looked for.

This explains the fact that the “empirics,” who included in their midst so many erstwhile adherents of Herophilos or Erasistratos, not only rejected dialectic and every form of physiological and pathological hypothesis, but even denied in general all possibility of the scientific foundation of medicine upon a basis of the ancillary sciences (particularly anatomy). Rejecting theoretical problems and deductive methods of research, they confined themselves exclusively to clinical observation and to the task of curing the patient, an end to which the wealth of new medicaments seemed to conduce.

The trend of empiric thought is best illustrated by a few of their sayings which have come down to us, particularly through Celsus. “The husbandman and the navigator are not trained by disputations but by practice.” “The important question is not what causes disease but what dispels it.” “Diseases are not cured by talk but by drugs.” The empirics did not give adherence to general medical axioms, maintaining that the same disease required other treatment for instance in Rome, than in Egypt or Gaul.

A later empiric asserted speciously, with arguments from philosophic scepticism, that medicine would never be able to lay claim to the title of science.

The renunciation of any deeper causal foundation for medicine was greatly favoured by the scepticism, which, arising from sophism and further developed by Pyrrhon and Timon of Phlius (a physician), took possession of an increasing number of philosophical schools.

This tendency was especially adapted, by means of investigations based upon theoretical

knowledge, to justify empiricism by means of logical arguments—it was, from the sceptical point of view, purposeless to seek the true but hidden cause of disease, but rather advisable to rest content with information derived from those obvious conditions governing morbid processes which were immediately to hand. A real blending of the philosophic sect of sceptics with the empirics came about only in very late times.

Anatomy was held in small respect by them, their contention being that the parts in the dead body behave quite otherwise from those in the living one and that even in vivisection, which they looked upon with horror, pain and loss of blood caused the most profound alterations—knowledge of the organs of dead or dying only, not of the living, was gained by such operations; accidental observations upon surgical cases were alone of possible use.

The empirics proudly claimed that their method was older than that of the dogmatists, a claim that can only be allowed if the empiricism of the eminent Alexandrian sect, equipped with logical arguments and all the aids and accessories of an advanced age, be put on the same footing as the crude empiricism from which the art of healing sprang. Hence the sect was later traced back to Acron of Acragas who, unlike the nature-philosophers, in his dietetic therapy treated of his subject from the point of view of experience.

Sympathy with empiricism may be traced in the views of Herophilos (absence of systematisation in pathology, broadening of therapeutic methods through observation and experiment, polypragmasia), but also in those of Erasistratos (restriction to causal investigation of symptoms; physiology a matter for investigators into nature, not for physicians). Philinos of Cos (ca. 250 B.C.), a pupil of Herophilos, Serapion of Alexandria (ca. 220 B.C.) and Glaucias of Taras (about fifty years later) are to be looked upon as the actual originators of this tendency.

The empirics, like the Hippocratists, paid most praiseworthy attention to clinical observation and like them too were guided in therapy at the bedside almost exclusively by “experience.” Nevertheless the empirics, though apparently reverting to Hippocratism, were in reality separated from it by a deep gulf, for they made no attempt to arrive at general laws from isolated facts; instead of taking individual conditions into consideration, they established ontologies from syndromes (*συνδρομή*) and hence, neglecting the indications, instituted a system of treatment which, instead of being suited to the individual patient, was arbitrarily directed against imaginary schemes of disease.

It must, however, be placed to the credit of the fathers of the empiric school that they so far surpassed the Hippocratists in that they systematised the technique of medical procedure and sought to free the clinical method of thought from the subjectivism of the individual observer.

As basis of experience was taken, first the repeated independent observation or autopsy (*τήρησις*, made by accident or experiment, or by imitation of such accident or experiment) together with reference to similar precedent observations (theorem); then, since the individual can only survey a relatively small area, the record of the observations of others (*ίστορία*):—

according to these two sources of knowledge the earliest adherents of the two sects called themselves *τηρητικοὶ* or *μνημονευτικοὶ*.

A third foundation was added by Serapion (the transition from one like to other likes, *μετάβασις ἀπο τοῦ ὁμοίου*), i.e. the conclusion by analogy, which makes it possible to adopt a correct line of treatment in new cases, for which neither individual nor vicarious experience provides a direct indication.

The similarity of disease-symptoms or of the parts affected may furnish a clue to the necessary remedy, or the similarity in action of certain remedies may point to a correspondence in morbid manifestations. It was an indispensable postulate for each of these sources of knowledge, which Glaucias incorporated into a philosophical scheme with the designation of "tripod" and individually analysed, that such knowledge should be attained by inductive methods and employed only for therapeutic purposes. The conclusion by analogy of the dogmatists, which was exclusively directed towards the investigation of causes of disease, was entirely rejected.

This rigid adherence to clinical observation, which indeed led to separation of essential symptoms from unessential, but took into account merely obvious occasional causes, the anxious avoidance of every theory, even if grounded upon anatomical knowledge, these could naturally lead to no ætiological comprehension of pathological conditions. Thus the disease-definitions of the empirics, which they called hypotyposes, were only nominally definitions, since they included neither remote causes nor the nature of the morbid processes. Worse than this, however, was the fact that in many cases correct treatment can only be undertaken after investigation into pathogenetic influences—a fact that did not permanently escape the far-seeing. It is, therefore, not to be wondered at that the empiric school should in part have been drawn into the vortex of crude empiricism which, making use of the *post hoc ergo propter hoc* argument, had amassed a considerable store of putative remedies, whilst in part it attained to a modified rationalism. The latter bent received later a methodic foundation at the hands of Menodotos of Nicomedia who, in order to counter the reproach of want of science brought against the empirics for leaving the causation of disease out of account, added to their methods of thought the so-called Epilogism, which at least aimed at the discovery of hidden occasional causes. This process may be illustrated by the following example:—If a physician, in examining a case of mental disease, finds traces of a former head injury, he would be justified, upon analogy, in accepting the former lesion as cause of the insanity.

The most meritorious achievements of the empirics lay in the domains of symptomatology, pharmacology and surgery, in keeping with the tendencies and methods which they pursued in their investigations. Many of their contributions to these subjects lasted through the centuries and assured the school numerous adherents down to the latest period of antiquity. Pharmacology was appreciably extended through the inclusion of a number of new drugs; the knowledge of poisons and their antidotes was increased, favoured by the conditions of the time; the preparation and investigation

of drugs were subjects of careful study, and in surgery the technique of dressings, the knowledge of appliances and operative methods underwent important improvements.

The empiric school reached its zenith in the person of Heracleides of Taras (commencement of first century B.C.), a pupil of the Herophilean Mantias. Heracleides based upon a wide practical knowledge and a conscientious study of the earlier literature not only a commentary upon Hippocrates and an apology for his sect, but also excellent works upon dietetics, the therapy of internal and surgical diseases, the pulse, preparation of and experiments with drugs, upon poisonous animals, cosmetics, military surgery etc. These works were much used and quoted, being highly appreciated, even by the opponents of the empiric school, owing to their acuteness of observation and their accurate descriptions.

The surviving fragments throw but a faint light upon the views and labours of Heracleides, so that we can only guess the meaning of the investigator. Facts of far-reaching importance were that he set on foot numerous experiments with drugs, that his methods of treatment were founded upon conscientious tests and, in contrast with other empirics, that he paid more attention to the mode of preparation of his materials and the indication for their use than to their number, novelty or rarity. Amongst his favourite remedies were cinnamon, pepper and balm of Gilead, but in particular, opium, the exhibition of which as a sedative and hypnotic he regulated most carefully. In addition to medicinal treatment he gave great attention to surgery (dislocations, apparatus for reposition of the hip-bone, operation for ankyloblepharon, polypus of the ear etc.) and to dietetics.

The most noteworthy clinical descriptions which have survived are those upon ileus, tetanus, croup, cynanche and phrenitis (which he divided into three forms, inflammatory, gastric and that due to cerebral degeneration).

Out of the large number of empirics the following find mention in the literature (with enumeration of prescriptions and titles of writings, mostly upon pharmacology): Zeuxis (the elder, commentator of Hippocrates, ca. 250 B.C.), Apollonios, "the empiric," and Apollonios Biblas ("the Book-worm," ca. 180-160 B.C.); Zophyros (who classified drugs according to their action and discovered a universal antidote "Ambrosia," ca. 100-80 B.C.), his pupils Apollonios of Chition (ca. 60 B.C., author of a commentary upon Hippocrates' work on joints and of a work upon epilepsy), and Poseidon (writing on plague).

In the Christian era came: Heras of Cappadocia, Menolodos of Nicomedia, the anatomist Theodas of Laodicea (ca. 100 A.D.), Ailios Promotos,

Agrippa and Sextus Empiricus, renowned as a sceptic philosopher (flourished 190-200 A.D.)

The achievements of the empirics or leading representatives of other sects in the surgical branches or pharmaceutics were advanced also by other practitioners and investigators who, belonging to no particular school, devoted themselves to specialised study on the lines of this or that teaching.

In surgery we know that the attainments of later antiquity hardly surpassed those of this age, if indeed they can be said to have equalled them, whilst their foundation indubitably rested upon the pioneer work of the Alexandrian era. Nothing remains of the surgical literature, but the study of later authors shows us what great advances were made in the knowledge of fractures and dislocations, in the recognition and treatment of herniæ, in the technique of dressings, and in particular operations (such as those for stone and couching for cataract). Of prominent individual practitioners we know little more than the names. Thus the following may be mentioned amongst the surgeons named in the history of the sects, Amyntas (discoverer of a dressing for fracture of the bridge of the nose), Gorgias, Heron (umbilical hernia, obstetrics), Neileus (apparatus for reduction of dislocations called "plinthion"), Nymphodoros, Protarchos, Sostratos (bandages, herniæ), Philoxenos (author of a general work upon surgery, also a gynæcologist), Ammonios, the lithotomist (inventor of an instrument for breaking up such stones as could not be extracted after section).

Cleophantos acquired fame as a gynæcologist and also exercised considerable influence upon later physicians by his doctrines on fevers, which he supposed due only to heightened pulse-frequency, by his development of dietetics and by his directions as to the medicinal use of wine. The Hippocratist Lysimachos (second century B.C.) also made his mark as an exponent of therapeutics.

Pharmacology and toxicology were not only subjects of industrious study on the part of physicians, but even aroused the keenest interest of dilettanti; it was a true expression of the spirit of the times that the lore of medicinal herbs and poisons was utilised as subject matter of didactic poetry.

The most important of the pharmacologists was the rhizotomist Cratevas (Krateuas), who lived at the court of Mithradates VI., Eupator. He was the author of two important works, an illustrated herb-book (ρίζοτομικόν) and a treatise upon pharmacology in general, which latter was celebrated for its excellent description of the action of metals. Cratevas' writings were the subject of many compilations by later authors.

Of toxicological works the *θηριακά* and the *ἀλεξιφάρμακα* of Nicandros of Colophon have survived. The *Theriaca* deal in 958 hexameters with the

symptoms and treatment of poisoning by the bite of poisonous animals; the *Alexipharmaca* with intoxications through vegetable (also animal and mineral) poisons and the appropriate antidotes.

In spite of many superstitious statements this work, though little quoted by medical authors, had a wide circulation and deserved high appreciation.

Nicandros is the first writer to mention the medicinal use of the leech.

It was not so much thirst for knowledge as apprehension or cruelty which aroused in many rulers of this politically disturbed epoch a predilection (as in the Renaissance period) for experiments with poisons and antidotes. Attalos III., Philometer of Pergamos, who lived in constant anxiety from the machinations of his enemies, "cultivated with his own hands poisonous plants, henbane, hellebore, hemlock, wolfbane in the royal gardens, collecting the juice and fruit to study their powers."

In order to gain familiarity with the effects of poisons and to discover antidotes he instituted experiments upon criminals; the resulting experience with poisonous and healing plants he bequeathed in writings through which many of his medicinal mixtures have been handed down to tradition. A similar fancy distinguished Nicomedes of Bithynia and Antiochos (probably Epiphanes) of Syria; from the latter originated a panacea against every kind of poison. The greatest renown, however, was achieved by the learned king of Pontos, Mithradates VI., Eupator (120-63 B.C.). Those plants were in ancient times named after him (Mithradatea, Eupatoria, Scordion) in order to keep his botanical attainments in honoured memory. Mithradates experimented upon subjects and relatives—whom it was his fancy also to treat surgically—with the most diverse poisons and antidotes. The most famous of the latter—a universal antidote, Mithradation—was compounded of fifty-four ingredients and held its place, in numerous modifications, during many centuries in the medicamentarium of scientific healing. In order to protect himself the king first took some of the antidote he had discovered, then poison. It is interesting, in the light of present knowledge, to notice that his purpose herein was, by increasing use, to immunise himself against poison. Similarly, with remarkable intuition, he mingled his antidote with the blood of Pontine ducks, since these animals nourished themselves upon poison and were therefore insusceptible to it.

After the fall and suicide of Mithradates his valuable toxicological memoranda were discovered and were then by command of Pompey translated into Latin by the grammarian Lenäus.

Not a few prescriptions also were ascribed to Cleopatra and handed down

by medical authors, as well as two writings, of which one, upon cosmetics, has perished, the other, upon diseases of women (*γυνέσια*) has survived. Cleopatra's tragic fate set the seal to the dominion of Rome over Egypt which had indeed long been virtually in existence.

The quickening spirit of investigation which distinguished the medical school of Alexandria gave way more and more to subtle, barren scholasticism, yet this school maintained its outstanding position even in the Roman world-empire, although only in competition with new centres of medical science.

THE TRANSLATION OF GREEK MEDICINE TO ROME

ON the heels of the conqueror with his rude soldierly virtues follows the ruler with his love of luxury and his aspiration towards refinement of manners and customs. This historical law finally compelled even the empress of the earth, invincible Rome, to lay down her arms before a yet more powerful sovereign in the shape of Greek culture which, earlier than the eagles of the Roman legions, had made subject the entire civilised world.

In her commanding position Rome had need of more of splendour, more of intellectual light than Latium unassisted could emit. If power were to go hand in hand with culture and beauty the Romans, since both these came to them only in Greek guise, had to grant free admission to Hellenic thought, speech, customs and art, though free independent achievement was hindered by the naturally unimaginative disposition of the race.

Whilst Greek influence made itself most distinctly felt only at the time of the Punic wars, traces of the same may dimly be discerned as far back as the time of the kings (Tarquins), where it added to the foundations of culture laid down by the Etruscans. The Hellenic sense of beauty, emanating from greater Greece, had by the early days of the Republic made its way to the Eternal City under the guise of religious observances, in the form of architectural memorials.

Every fibre of the Roman being was permeated with Hellenism, the Scipios having shown how well Roman heroism could be mated with Greek refinement. Hellenism beautified and spiritualised religion, revolutionised manners and home-life and raised education and instruction to a hitherto undreamt-of level. The achievements of Rome in poetry, philosophy and rhetoric, in arts and crafts, can hardly be considered otherwise than as a more or less successful copy from Greek models. All that was best in taste, all elegance, science and art was Greek ; only in architecture, in war, in law and politics did Rome preserve her originality.

The decline of the national virtue made itself felt, not as a direct result of the invasion of Hellenism, as was maintained by representatives of the

old Roman discipline and customs under the leadership of Cato the Censor, but as a striking accompaniment of it. In the place of national patriotism arose a colourless cosmopolitanism, philosophic doubt displaced reverent belief in the gods, without supplying anything better in exchange.

The era of Lucullus with its sensuous refinement had other necessities and another outlook upon life than had the simple coarse-grained Rome of Cincinnatus. Ever-increasing luxury with its sequence of weakness and of diseases hitherto unknown or unnoticed; the scepticism of a neuro-pathic nobility—these demanded a system of medicine different from an empiricism acquired by the simplicity of a homely agricultural people, from a theurgy based upon credulity of the Roman priesthood. In this respect everything was to be expected of enlightened Hellas, whose art of healing heralded an era not yet dreamt of in Latium, wherein sacrifices, prayers, expiations, magical practices and primitive devices should give way to a science of medicine founded upon rational experience and upon critical observation.

Many causes were at work to prevent the evolution from the Roman nation of a civilised medical system. The simple habits of life of a race fundamentally sound and hardened from youth up prevented the onset of many diseases. Periodical outbreaks of pestilence only fed an already crass superstition without stimulating thirst for knowledge. A constant succession of wars stifled scientific interest, the whole energy, the whole intellect of the worker being devoted to the service of a single idea—the good of the state, the growth of power. For the Roman patriot the only worthy stage was the forum or the battlefield, every other pursuit was left in the hands of slaves, and could not free itself from the taint of servitude.

For six centuries autochthonous Roman medicine remained at a uniform stage of development which other civilised nations had passed thousands of years before. Wedded to religious mysticism and crude popular customs it stood out as an anachronism in an era which already saw Hippocratism crushed by the pedantic speculative erudition of Alexandria.

Household remedies, hallowed by tradition, simple surgical manipulations, magical procedures (spells) inherited mostly from the Etruscans, Marsi, and other old Italian races, constituted the sum and substance of ancient Roman medicine. This is best indicated by Seneca's dictum. "*Medicina quondam paucarum fuit scientia herbarum, quibus sisteretur fluens sanguis, vulnera coirent.*" The principal practitioner of this folk-medicine—in epidemics or long-continued sickness only the gods and their priest could be of service—was the "*pater familias*," who rendered

aid to his dependants and to the "familia rustica," women, friends and slaves.

It is most probable, however, that even in very remote times there were in Rome people who practised the art of healing as a profession either exclusively or as an accessory occupation (originally Etruscans, *haruspices*).

In war the soldiers dressed one another's wounds, but how imperfect such aid was may be deduced from the fact recorded that after the battle of Sutrium more combatants succumbed to wounds than were killed by the enemy.

The medical mythology of the Romans sprang originally from the folk-beliefs of the Etruscans and of ancient Italian races, but was enriched by loans from the mythology of foreign nations. Religion and mortal life were intimately bound up together; physiological processes, the causes of disease and diseases themselves were personified. Of old-Italian origin are the following: *Carna* (protectress of the intestines; at her festivals—"Carnalia"—prayer was offered "ut jecinora et corda, quæque sunt intrinsecus viscera, salva conservet"), *Bona Dea* (a mysterious goddess of healing whose temple no man dared enter), *Minerva* *memor* or *medica* (goddess of wisdom, particularly of medical science), *Diana* (Moon and birth-goddess, as *Diana Thermia*, goddess of hot springs), *Mars* (as protector from pestilence), *Dea Febris*, *Mephitis* (goddess of miasmata, personification of the dangerous sulphurous fumes), *Meditrina* (Oscan goddess of medicine), *Dea Salus* (Sabine goddess of health), *Angitia* (originally goddess of antidotes worshipped by the *Marsi*), *Silvanus* etc.

Sexual life and the development of the child were under the care of a whole series of deities. *Diana* and *Juno* were goddesses of birth under the names of *Lucina* (*Dea Natio*, *Sospita*, *Conservatrix*), and *Carmenta* (festivals "Carmentalia," supplicated according to the fetal position as *Porrima* (anteversion) or *Postverta*). The sexual processes of woman up to the time of conception were regulated by the gods *Pilumnus*, *Farcinus* and the goddesses *Rumina*, *Deverra*, *Cumina*, *Mena*, *Uterina*; fruitfulness was dispensed by the god *Mutunus Tutunus* (corresponding to *Priapus*) to whom women, veiled, made sacrifices; young bridegrooms fearing impotence, looked for help to the deities, *Deus Subigus*, *Dea Prema*, *Dea Pertunda*, *Dea Perfica* etc., whose names sufficiently indicate their influence.

Intercidona watched over the navel of the infant, *Ossifraga* the bone development of the child. At the *Lupercalia*, celebrated in honour of the woodland field god, women also took part in order to achieve fruitfulness.

From the Greeks were adopted:—*Apollo* (*salutaris*), then *Asclepius* as *Æsculapius* (his cult was introduced into Rome in 291 B.C. after a severe pestilence), *Hygieia*, *Hercules* (the god of warm springs) etc. In the Imperial era the cult of Egyptian gods of healing acquired great significance, *Isis*, *Osiris* and *Serapis*. Upon votive tablets found in Spain the name of the enigmatical god *Endovellicus* is named. The medicinal springs, which from the earliest times had enjoyed a great reputation amongst the Romans, were presided over by *Nymphæ salutiferæ* and many inscriptions point to the honour paid to them. Some springs, particularly hot ones, possessed cure establishments and oracles.

Convalescents expressed their thanks for supernatural aid by means of votive offerings, *Donaria*. Numerous discoveries afford us an insight into the different varieties of these. Ornaments, coins, small effigies of the gods etc. were thrown into the sacred springs: in the sanctuaries were suspended votive offerings of marble or terra-cotta which represented either in model form or as pictured in relief the patient or the affected part of the body (eyes, ears, breasts, abdominal organs, sexual organs, arms, hands, legs, feet, hair of head etc).

The representations of viscera which have been found are not modelled with a knowledge of human anatomy but upon analogy with that of animals. They may be divided into representations of the opened abdominal cavity, those of a group of viscera, or individual organs (heart, trachea, lungs, diaphragm, kidneys, spleen, stomach, intestinal canal, bladder, male and female sexual organs).

As with the Greeks and Orientals, so with the Romans, public sacrifices ("consultatoria sacrificia"), borrowed from the Etruscans, played an important part. These lay in the hands of the haruspices who foretold the future from viscera in the same way as the more highly esteemed augurs prophesied from the flight of birds.

As the sacrificing priest had narrowly to inspect the organs of the slaughtered animal (from the point of view of position, appearance and behaviour on section), a certain degree of anatomical and even pathological knowledge was naturally developed.

The traditional technical terms of the Roman sacrificers show that they possessed a topographical knowledge of the organs, particularly of the liver. The general appearance of the lobes was known, the outflow of blood, the appearance of the processus pyramidalis, of the gall-bladder and of the cross-section of the vessels. Models of sheep's or calves' livers of bronze or alabaster served as patterns for the haruspices—two of these have been discovered, the bronze liver of Piacenza and the alabaster liver of Volterra.

In addition to liver and gall-bladder lungs, heart and omentum were taken into consideration.

In order to appease the deities in such matters as warding off epidemics feasts of the gods were instituted—Lectisternia—dances to the accompaniment of the flute, whilst peculiar pomp surrounded the custom according to which the specially chosen dictator during pestilence drove in a nail in the temple of Jupiter Capitolinus (the custom was Etruscan and was originally connected with time measurement).

The assumption is justifiable that the haruspices utilised their anatomical knowledge as surgeons. The existence of a native medical order in Latium is in any case proved: the name "medicus" of Italian derivation and occurring with *mederi*, *medicina*, in the oldest Latin authors indicates this.

The terminal "medicus" is brought into connection with the Oscan word "meddix" which designated a kind of official. Dionysius of Halicarnassus makes mention of physicians in the epidemic of the year 451 B.C.; the law of Aquila (from the fourth century B.C.) presupposes a free physician held responsible for a neglected operation on a patient: "Si medicus, qui servum tuum secuit, dereliquerit curationem ejus et ob id mortuus fuit servus, culpæ reus erit." The early Roman healers did not succeed, however, in winning for themselves any considerable position, or they would not so quickly have been ousted by the immigrant Greek physicians.

Hygienic measures and sanitary regulation made their appearance surprisingly early amongst the Romans considering the low status of medicine.

To the former of these must be ascribed the construction of the Cloaca Maxima and aqueducts (of which the first was built by Appius Claudius, 312 B.C.), the planting of myrtle and laurel-groves on the seashore (to ward off the exhalations from the marshes), the frequency of baths (the ancient Roman house possessed its separate bathroom or lavatrina). Ancient laws ordered the burial of the dead ("hominem mortuum in urbe ne sepelito nec urito"), prescribed Cæsarean section upon women dying pregnant, fixed the legal duration of pregnancy as ten months ("in decem mensibus homines gigni"), placed lunatics under the guardianship of relatives ("si furiosus sit, agnatorum, gentiliumque in eo pecuniaque ejus potestas esto"), made witchcraft punishable ("qui malum carmen cantassit, coerceto"), forbade the drinking of wine by women ("si vinum domi biberet, ut adulteram puniunto"), supervised the sale of the necessities of life etc.

As early as the third century B.C. Greek "physicians" and midwives, attracted by the growing wealth of Rome, commenced to immigrate.

At the outset the majority of them can hardly have been reckoned amongst the most distinguished representatives of the Hippocratic art, but rather adventurers, greedy of gain and little troubled by conscientious scruples, who had at home occupied no more exalted position than that of medical assistants in the gymnastic schools. Now, equipped with the necessary cunning, they audaciously traded upon the credulity of the multitude—a qualification to practise not being required in Rome. It was in great part due to such individuals that Greek medicine, of which the utmost had been expected, was no sooner known than discredited. Pliny says of the Roman people: "*medicinæ etiam avidus, donec expertam damnavit.*"

This lack of success was no doubt to a great extent due to the dislike—even yet prevalent—of the people to the severer surgical undertakings and to their hatred of foreigners, stimulated by nationalists and native physicians.

A typical fate befell Archagathos, an immigrant from the Peloponnesus in 219 B.C. and, doubtless wrongly, described by Pliny as the first Greek physician in Rome. Archagathos at first won great confidence by notable dexterity in the treatment of wounds and ulcers. He received such high recognition that the senate bestowed upon him the right of citizenship and established him in a shop (*taberna*) in a busy locality. Emboldened and over-confident this "*Vulnerarius*"—wound-surgeon—as he was called in honour by the populace dared to undertake more serious operations. It was not long before his rashness in cutting and burning aroused such ill-will that people would no longer tolerate this "*Carnifex*" as he was now called in derision and expelled him and all physicians with him.

These statements are derived from the patriotically-minded Pliny and must be taken *cum grano salis*. It was upon physicians in particular that the prevalent Græcophobia concentrated itself because it was feared that through their intimate relationship with the populace the old manliness and therewith the early Roman character would be undermined. Doubtless isolated instances purposely exaggerated may have arisen; as we know from later times both free and enslaved physicians have actually allowed themselves to be made use of, relying upon their immunity or under the stress of servitude, for shameful ends (even poisoning?). On the other hand the fact is well-established that even the sharpest attacks of the enemies of Greece did not succeed in entirely shaking trust in Greek medicine, immensely superior as it was to that of Rome. In what an embittered manner the contest was carried on by the guardian of early Roman

manners and customs, the honourable but stern Marcus Porcius Cato (234–149 B.C.) can be deduced in part from the “*Præcepta ad filium*” in which he accuses Greek physicians of having conspired against the lives of Romans. Cato forbade them his house; as the early Roman father of the family he devoted himself to the treatment of his own household, including his slaves, chiefly using an old writing or “*Commentarium*” upon folk-medicine. Though his son followed his example, the Romans did not; in spite of the edicts of banishment, which were doubtless not put into effect, the Greek physicians maintained their position, and their numbers increased daily.

As the Greek philosophers undermined popular religion and infected Roman youth with the poison of scepticism, the Senate repeatedly forbade residence in Rome to philosophers, both individually and collectively, such an edict being promulgated in 161 B.C. Six years later appeared a mission from Athens, consisting of the academician Carneades, the Stoic Diogenes and the peripatetic Critolaos, of whom the first in particular—knowledge of Greek being already widespread—made a great impression by his eloquence. Again the national party attempted to avert the danger by the early expulsion of the mission. After Cato’s death a decree was said to have been published ordering the banishment of all Greeks; how far the ordinance was from being stringently carried out subsequent events prove and even had the philosophers been expelled the physicians possessed already sufficient support from their many well-wishers to be able to ignore the edict.

Undeniably, however, in the eyes of the Romans a certain taint clung for many a day to Greek physicians, and long after the poetry, art and philosophy of Greece had obtained the greatest recognition in Rome, Hellenic medicine was denied any warm adherence amongst the cultured as, for instance, a saying of Cicero’s distinctly shows.

It was not sufficient that so-called physicians came to Rome, it was required that a man should arise who understood how to bring his art into touch with the culture and views of life of the eminent Roman. He only could really succeed in translating Greek medicine to Rome.

ASCLEPIADES

THE naturalisation of Greek medicine in Rome was mainly the work of Asclepiades of Prusa, a physician apt in rhetoric, learned in philosophy, and of exceptional worldly wisdom. He succeeded through striking practical achievements in overcoming the national prejudice, and knew how to adapt scientific medicine so as to be most suited to contemporary Roman taste.

Asclepiades was probably born ca. 124 B.C. in Prusa, a town of Bithynia, and early devoted himself to the study of rhetoric, philosophy and medicine. To extend his knowledge he appears to have spent some time in Parium, on the Hellespont, in Athens, probably also in Alexandria before going to Rome in search of fortune. Here his rhetorical gifts and social address brought him into friendly intercourse with prominent men like L. Crassus, Cicero, Atticus, M. Antonius and Q. Mucius, and he quickly acquired the reputation of an incomparable physician by means of apparently new methods of treatment. The extent of his fame is shown by the fact that he was sent for by Mithradates of Pontus; Asclepiades, however, refused the invitation and only sent his works. An episode has been handed down to us by several authors which may be interpreted, now as indication of his wonderful power of observation, now as proof of his charlatanry, which did not stop short of gross deception. "As he once betook himself from his country seat to town," the story goes, "he saw a great funeral procession; he drew nearer in order to find out whose it might be, and, on the other hand, that he might learn something through the dead man in consonance with the rules of his art. Although the face of the latter was covered with spices, and smeared with sweet-smelling salves, Asclepiades saw certain indications that drew his attention; and repeatedly touched the body, eventually finding that there was life in it. He announced that the man still lived, gave directions that the torches and fires be extinguished, the funeral pile removed and the funeral meats brought from the tomb to the table. A murmur arose; some said that the physician was to be believed, others mocked at him and his profession. Then Asclepiades, in spite of the opposition of the relatives—either because they were already in possession of the inheritance or because they yet disbelieved him—succeeded with difficulty in bringing about a short respite for the 'dead' man. He brought the man thus wrested from the hands of the bearers, as though from the underworld, home, and restored breath to his body, and by means of drugs called back the life that was hidden in the depths of the body. At table the fame of the wise man was spread." Intoxicated by the applause of the susceptible multitude, Asclepiades caused himself to be hailed as one "come from heaven," and with an exaggerated self-confidence lapsed into mountebank utterances or even performances which have tarnished his fame in the eyes of posterity, and were the cause of the capable, if one-sided, therapist and medical philosopher being looked upon as a quack. He shared with the majority of reformers immeasurable conceit and contempt of his predecessors. Full of years he died through a fall downstairs and

justified his dictum—"He did not wish to be considered a physician if he himself should fall ill."

Of even greater importance than the fruitful reconciliation which Asclepiades brought about was the accompanying movement of reform in medical thought and therapeutics. With the whole force of his impulsive personality he entered the lists against the torpid humoral pathology and was the first to combat the mischievous traditions followed by the later Alexandrian school under shelter of the name of Hippocrates, or based upon so-called "empiricism" and consisting in the employment of purgatives, emetics and diaphoretics, of venesection or even of methods of superstition. He replaced this by a systematic physical and dietetic method of treatment deduced from a speculative mechanical physiology and solidist pathology. Hence he became a factor of the greatest importance in the general development of Greek medicine which, under Alexandrian sway, had already become stagnant, and he was one of the most prominent figures in the history of medicine, his principles, if open to much criticism, yet influencing therapeutics even to this day.

Of the works of Asclepiades, written (to the number of about twenty) in the purest Attic, only quotations in later literature are in existence, often coloured in a partisan manner according to the standpoint of the author. They dealt with general principles, respiration and pulse, acute diseases and periodic fevers, phrenitis, morbus cardiacus, ulcers, dropsy, alopecia, health regimen, therapeutical measures and preparations, clysmata, medicinal use of wine etc. The domination of Galenism, which stood in strong contrast with the methods of Asclepiades, brought it about that this author was little mentioned after the fourth century A.D., not at all after the sixth. He only came to the fore again in the sixteenth century and many systems in later medicine drew inspiration from his principles. In the year 1700 a bust was dug up in Rome near the Porta Capena bearing the inscription "Asclepiades" and this has been supposed to be that of the Bithynian.

In so far as Asclepiades goes back to first causes to find support for his therapeutical methods he separates himself from the empirics; in regard to his fundamental conceptions of the organism, on the other hand, he comes into sharpest conflict with the exponents of the rationalistic tendency who take their stand more or less firmly upon the Platonic-Aristotelian philosophy. In the doctrinal system of Asclepiades atomism for the first time exercises its sway, and that in the modification which owns Epicurus or Heracleides of Pontus as its originator. In choosing this materialistic, metaphysical system, which entirely excludes the teleological, the intangible and the supernatural, as the basis for medical theory, the Bithynian at once made certain of the approval of the intellectual aristocracy of Rome, who were convinced adherents of Epicureanism, and who found in the younger contemporary of Asclepiades, Tit. Lucretius Carus, a poetic leader.

Heracleides and Epicurus explained all activity as due to the movement of atoms in space. Between their systems there is the difference that the atoms according to Heracleides are divisible, whence he used, instead of the terminal *ἄτομος*, the word *ὄγκος* as designation for the ultimate particles.

The doctrine of Asclepiades teaches that the human body is built up of an infinite number of atoms (*ὄγκοι*) upon the movement of which life (including intellectual activity) depends. Combinations of these atoms (*συγκρίσεις*) form innumerable tubular spaces, the body "pores," which are endowed with sensation, in which atoms of different size are in constant movement and through which the stream of body-juices flows. The minutest globular smooth atoms (*ὄγκοι λεπτομερεῖς*) compose the substratum of the psyche and correspond to the *pneuma*. Respiration and nourishment provide the materials necessary for maintenance; all physiological processes are carried on purely mechanically, no especial (organic) powers coming into play.

The pulse is a movement of arteries, whose alternate expansion and contraction is made visible by the entrance of *pneuma*; respiration results from entry into the lung of outer air due to its greater density and weight; as soon as the thorax is distended to its greatest capacity the air finds its way out again, leaving behind its purest and most delicate parts. Hunger ensues from relaxation of the coarser, thirst from relaxation of the finer pores; food-stuffs are not digested in the ordinary sense of the term, but are merely subdivided into their ultimate particles, which therefore are absorbed into the body unaltered as they were taken in, and are distributed through the narrowest of the canals (pores). The urine, not touching the kidneys, comes to the bladder in vapour-form and is there condensed.

Asclepiades denies the purposefulness of the vital forces and is the most important representative in antiquity of the mechanical attitude of mind in medicine. In his physiological explanations he partly follows Empedocles, but more closely Democritos. He compares the lungs with the *κλεψύδρα*, the respiratory mechanism with the attraction in cupping. He advances as proof the fact that no "digestion" or "coction" takes place, and states that he never observed, either in vomiting or upon opening the stomach, food in a digested condition. It is important to note that Asclepiades foreshadowed the absorption of the finest food particles through invisible canals and excretion by the same process, that is to say metabolic change in the tissues.

Asclepiades also investigated many physiological problems experimentally, thus he combated the assumption of the head or heart as seat of the soul with the argument that animals can live an appreciable time after these parts are removed.

The *φύσις* of Hippocratism, *i.e.* the sum-total of organic phenomena and their purposeful processes of reaction, had to give way in Asclepiades' system to a purely physical conception excluding all trace of teleology

and formulated in the sentence: "Nature is nothing else than the body and its movement." This idea dominates his pathology and therapy and impelled him to become the most strenuous opponent of the great physician of Cos.

Health is dependent upon the proper proportion of atoms (*συμμετρία*) to pores whereby the movement in these can take place in free and undisturbed fashion. Sickness is primarily to be referred to a disturbed movement of the atoms (*ἐνστασις, στάσις*).

Abnormal size or shape of the ultimate particles, abnormal width, narrowness or distortion of the pores induce too rapid or too slow a movement or accumulation of the particles resulting in obstruction of the pores (*ἐμφορίζις*) and therewith diseases, the difference between which is dependent upon the passages (pores) and the parts of the body affected. Changes in the juices and in the *pneuma* may, in slight affections, be of ætiological importance; they are not essential, but only occasional, causes.

The powers of observation in medicine of the Bithynian were luckily not at all influenced by his atomistic solidist pathology; he paid, on the contrary, minute attention to the pulse and did good work in the description of disease. Thus he distinguished more sharply than heretofore between acute and chronic diseases, gave an excellent account of malarial fevers, distinguished several forms of dropsy (one of rapid, another of slow onset, one afebrile, one form accompanied by fever or arising from quartan fever), and considerably advanced the knowledge of convulsions and mental disorders. The rhythmical progress of certain diseases did not escape him, he admitted the existence of crises, but did not subscribe to the belief in definite critical days.

Asclepiades distinguished tonic and clonic convulsions from simple twitching, taught that epilepsy could also be brought about by a concussion or laceration of the meninges (*i.e.* traumatically) and referred mental disturbance to an affection of the meninges. He differentiated with keen perception psychical anomalies and left behind him accurate and clear-cut definitions of frenzy, lethargy and catalepsy. It is worthy of remark that he distinguished frenzy from those conditions of psychical excitement which arise as symptoms in the course of pneumonia or pleurisy.

The therapeutic tendency which Asclepiades, with colossal self-confidence, looked upon as the only right one, was a logical deduction from his theory of disease. To the Hippocratic axiom, "Nature is the healer of disease," he opposed the dictum, "Not only is Nature useless, but it is even sometimes harmful. Cure is nothing but a return to normal atomic movement, a process which can only occur by mechanical means. A natural healing power, regulating by design, exists only in fancy, everything is dependent upon the active energy of the physician." Hippocrates

with his therapeutic system, continually expectant, interfering little in the process of disease and looking upon himself only as the servant of nature, appears indeed from this point of view as the exponent of a deadly art (*θανάτου μελέτης*). Since diseases in no sense represent effects of a *materia peccans*, but are based upon minute mechanical disturbances, so crude evacuants (emetics, purgatives) cannot produce the desired effect, but only those healing agents which bring the flagging atomic movement once more into normal action, *i.e.* mechanical, physical, hygienic and dietetic influences. Asclepiades laid chief stress upon measures in keeping with these principles: fasting, fixed régimes, contra-indication of meat (as in epilepsy), dry diet (as in dropsy), medicinal use of wine, carefully regulated walks, running, riding, moderate gymnastics, massage (friction varying in intensity and duration combined with inunctions of oil), passive movements (being carried in hanging beds etc.), cold sponging, hot and cold vapour baths, douches, swinging baths (*balinea pensilia*), water-drinking, clysters etc. He also took into consideration the influence of air and light (with mental cases also of music). Internal medication he seems to have employed but sparingly, the use of emetics and purgatives he combated vigorously, although he made use of external applications (fomentations, plasters, scents, sternutatories), and in clearly-indicated cases also surgical procedures, such as venesection (according to the seat of the disease, in well-defined localities, but only in painful affections), scarification, cupping (as in angina where also he eventually made incisions in the soft palate), paracentesis (dropsy). In imminent suffocation he also recommends the performance of laryngotomy.

In the light of the therapeutic prescriptions of Asclepiades the claims of many later physicians to priority in these physical and dietetic methods disappear, at least as far as the principle is concerned, and they can only claim credit for developments in harmony with their age, or for technical improvements. But even the Bithynian, who self-complacently and pugnaciously insisted upon his originality—he was named *οἰνοδότης* on account of his frequent medicinal prescription of wine, *ψυχρολούτης* from his predilection for hydrotherapeutic measures—actually reverted to methods of treatment which, to say nothing of a less remote past, have found expression particularly in the Hippocratic writings and were primarily derived from the Greek gymnastic schools. The only actual novelties were his underlying theory, his methods, which kept pace with progress, and his systematic, extended, carefully regulated mode of employment of them.

The cause of progress was advanced by the fact that (with pardonable

partiality) he emphasised the value of his methods, occasioned their wide dissemination and successfully combated the antique methods of traditional therapy.

Asclepiades is, both as regards theory and practice, less the starting-point than the summit of a wave whose undulation extended far back into the past and the existence of which was only obscured by the then prevailing school of thought. His closest relationship is with Erasistratos.

According to the ancients Asclepiades was originally an adherent of Cleophantos, who developed dietetics and made great use of wine as a medicine. His school approximated to that of Erasistratos, who considerably simplified therapeutics and placed reliance mostly upon mild purgatives, clysters, wine, fasts, dietetic regulations, gymnastics, baths, cold affusions, friction, individually regulated walking exercise etc., only with less emphasis and less system than Asclepiades. Erasistratos and Cleophantos in their turn followed closely upon the lines of Chrysippos and through him upon the Cnidian tendencies of the Hippocratists and of the Italian school, the latter in particular making use of the dietetic and physical therapy borrowed from athletes and gymnasts. It is an interesting fact that through Asclepiades this method of healing thus once more acquired recognition upon the soil of Italy. Even his theoretical views are partly rooted in the teachings of Erasistratos and more deeply so in the Cnidian-Italian school.

Erasistratos rejected the doctrine of the four elements, looked upon the body as made up of atoms, denied the universal existence of purpose in nature, sought to explain physiological occurrences upon a purely physical basis, to a limited degree embraced solidist pathology, sought the cause of most affections in mechanical disturbances (alterations in the pneuma-passages) and was the first energetically to combat the authority of Hippocrates. Many of these salient points are also characteristic of the Cnidian or Italian schools, the doctrine of pores was in a sense peculiar to the latter.

That the ideas of Erasistratos should have had so great an influence upon Asclepiades need cause no surprise when the fact is taken into consideration that the school of the former received a fresh impulse in Asia Minor about 100 B.C.

Amongst other details may be mentioned the fact that Asclepiades treated febrile complaints in their early stages upon the principle that the patient's strength should be lowered by bright light, long wakefulness and abstinence from fluid (even washing out the mouth was forbidden). Later, however, he met the patient's wishes by ordering luxurious meals and wine, which circumstance made his methods of treatment extremely popular. Of wine, which was his chief standby, and which he looked upon almost as a panacea, he was wont to say that its usefulness brought it near to the power of the gods. He administered it now pure, now diluted with water, now impregnated with salt, or warm, particularly in remissions of fever or in conditions of weakness.

Venesection he employed with discretion and explained that its value was dependent upon the climate in which the invalid underwent treatment. Patients with pleurisy, for instance, bore it well in Parion and on the Hellespont, but not in Athens or Rome. Instead of administering purgatives he enjoined abstention from eating or, in order to overcome obstruction by mechanical means, ordered clysters, the excessive use of which, however, he also thought harmful.

In every disease he prescribed a rigid diet, even in alopecia, in addition to external treatment he laid great stress upon a definite régime (abstention from meat, wine etc.).

It is interesting to note that dry-feeding was known to him. Massage he employed as a soporific, e.g. in mental disturbance, for which in a most creditable manner, he introduced psychic treatment, mainly by music and song; "phrenitic" patients he had brought into the light because in the dark subjective visions were not corrected by real impressions. Remarkable methods were, treatment by oscillation in hanging beds, and the balinea pensilia

(swinging baths). In surgery it is known that Asclepiades explained spontaneous dislocation of the femur as the result of an inflammation and that he advised laryngotomy and tracheotomy in suitable cases.

In contrast with medicine as it prevailed in Rome, crude and subject to superstition, the progress thus attained was so illuminating that Asclepiades must have appeared in his age as a miracle-worker, having undoubtedly great power of suggestion at his disposal. He had two mottoes: "Tuto, cito et jucunde" and this: that every competent physician should have twofold and threefold remedies ready to hand; these dicta he sought, as far as possible, to justify. Two factors were at work favourably influencing the reception of this method of treatment—for the most part a pleasant method. On the one hand was the fact that, stripped of its philosophical cloak, it rested on a foundation of popular approval, *e.g.* through allusion to the detrimental effect of drugs upon taste and digestion. On the other hand it represented by its invigorating tendency, the yearning of this nerveless age for its ancient manhood. Hence it was that the magic springing from his impressive personality alone passed with Asclepiades; that the discriminating individualisation which the Bithynian, despite his opposition to Hippocratism, practised in the Hippocratic spirit, became a lost art. Hence, too, it arose that the method of treatment which kept in view the general condition and was carried out with but few accessories, gave way only too soon to a schematic tendency and to a stereotyped meddlesomeness. Yet even the skeleton, which is all that is left of the Bithynian's therapeutic regeneration, bears witness to the ardent spirit which once informed it.

THE METHODISTS

It was given to the genius of Asclepiades to regard therapeutics in the aspect of a subtle theory and yet to retain individual freedom of action in his art. The rank and file of physicians, however, following in his footsteps required more sharply defined, more easily grasped guiding principles which should pave the way for mediocrity and, at the sacrifice of individual attainment, once for all put an end to vacillation between empiricism and speculation, changing clinical activity into a comfortable rule of thumb.

From this need of a more rigid adjustment, of a simplification of medical thought and action, sprang, as the name implies, the school of the Methodists, which, founded by an adherent of the Bithynian, Themison of Laodicea (ca. 50 B.C.), rapidly developed into a rival of the humoral dogma on equal terms with it, and which, in number of its adherents and in importance for the future, was little behind Hippocratism. The levelling spirit of the age watched over the cradle of this school, but in its innermost being may be seen, as in other domains of culture, a tendency to infuse Greek spirit into the barren Roman body.

Themison of Laodicea was already advanced in years when he turned from the pure doctrine of his master Asclepiades, and, from his numerous writings, he appears to have only gradually evolved his system. According to a satire of Juvenal he was anything but a fortunate physician. We gather from quotations that he deserves special recognition for his description of the treatment of chronic affections (a province in which he is in reality the first author) for his account of cachexia, satyriasis etc., for his additions to *materia medica* (to which he added leeches, and many compound medicaments, *e.g.* the poppy-preparation *Diacodion* etc.), and finally for his work upon gynaecology.

The methodic system, like a reflection of the temperate practical Roman mode of thought, with its leaning towards formalism, with its complacent clearness, often attained at the expense of profundity, seems at the outset fashioned for practice and, disregarding wider observation of nature, confines its activities to the restricted area of a few ideas dogmatically constrained into universal applicability.

Themison, in addition to the atomistic pathology of Asclepiades, took as the starting-point of his doctrine the comparison of diseases one with

another, the search for common characteristics. Thus he eventually attained to the one-sided, clear-cut conception that in the realm of heterogeneous disease-processes there existed essentially only two fundamental varieties (*κοινότητες*, *communitates*) namely the condition of rigidity, of tension—*στέγνωσις*, *status strictus*—or the condition of relaxation—*ρύσις*, *status laxus*. Both tension and relaxation depend upon abnormal conditions of the pores, which in the former case are too contracted and narrow, in the latter, on the other hand, too loose and wide (solidist pathology). Which condition predominates, whether pathological increase or diminution of the normal tone, can easily be deduced from the general condition of the body, but in particular from the excess or deficiency of excretions or secretions or from loss of blood etc. Treatment consists in remedying the *strictum* or *laxum* by means of opposing therapeutic measures acting upon the whole body.

This is brought about by relaxation or contraction, by imparting tone, the only “indications” besides the “community” taken into consideration being the condition of acuteness or chronicity of the disease or its stage of increase, stand-still or decrease.

In the classification of disease according to the principle of communities, a certain arbitrariness reigned; the majority of acute affections belonged to the condition of *strictus*, the majority of chronic affections to that of *laxus*. As means of relaxation were reckoned:—withdrawal of blood (leeches, cupping, scarification, venesection upon the side opposite to the affection and continued to faintness), warm baths, poultices, inunctions with warm oil, vapours, fasting and lowering diet, moderation in sexual indulgence, and only seldom and under special circumstances were diuretics, diaphoretics and laxatives ordered.

To the constricting, astringent, tonic measures belonged cold affusions, poultices and baths, change to colder air, invigorating diet, wine, vinegar, alum, narcotics etc. The fundamental principle of Themison with its dazzling simplicity, had naturally to be modified in face of the immense deficiencies which practical application of this doctrine revealed. In the first place the fact could not escape observation that “*strictum*” and “*laxum*” may concur in the same disease (*e.g.* in epilepsy and paralysis), wherefore the condition required a twofold treatment. From this consideration arose early the accessory idea of a *status mixtus*, *τὸ μεμιγμένον*, which third community was to be combated according to the preponderance of one or other quality.

But these three communities did not suffice in the long run when it became necessary to establish the therapeutic indications and individual

peculiarities in cases of a surgical nature or in intoxications. Thus under the pressure of experience further new generalisations were continually being evolved, as *e.g.* the "prophylactic" community in injuries, poisoning, etc.

In surgery four categories or communities of disease were distinguished. 1. Foreign bodies, which penetrate from outside; these are to be withdrawn. 2. Alterations of position (fractures, dislocations); these are to be replaced. 3. Foreign structures (tumours, abscesses); these are to be removed or incised. 4. Abnormal condition of parts (arrested development, ulcers etc.) through loss of substance; this is to be made good.

Such amplifications of the doctrine of communities detracted from the unity of the underlying principle and were in fact only the expression of perplexities which were bound to spring from a pathological theory which abstained from deeper ætiological explanations, from investigation into the seat of disease, and which presumed, in a one-sided consideration of merely secondary conditions, entirely to neglect not only the polymorphism of disease but also the individuality of the patient.

Methodism sought to escape the clutches alike of empiricism and of dogmatism. Its adherents chose the middle way. They did not, like the empirics, confine themselves to the purely practical handling of remedies but sought by theory to explain pathological processes. They did not remain content with mere evidence of the senses but, in contrast with the dogmatists, disdained investigation into first causes and localisation of disease, or establishment of the ætiological association of symptoms, clinging to certain disease-states arbitrarily selected from the mass. To the methodist school not only physiology, but anatomy, pathological anatomy in particular, which had recently come to the fore in Alexandria, was, like ætiology and symptomatology, considered superfluous.

The methodists did not entirely dispense with anatomy in their medical training, many of them pursuing this study closely, but, for the most part, it was considered sufficient to be familiar with the names of the parts of the body.

In the light of the new doctrine previous scientific endeavours almost lost their value and in particular the great demands which Hippocratism made upon medical attainments and individuality were no longer insisted upon. The saying of the old master "Art is long, life is short" was in fact reversed. Naturally, where the attainments necessary for a medical career were so small the swarm of adherents increased greatly even in Themison's time, and the numbers of the unqualified and base element were, in the decline of contemporary intellectual life, still further increased, since Themison's pupil, the weaver's son, Thessalos of Tralles in Lydia made pretence of teaching the whole of medicine in six months, *i.e.* his still further simplified system, declared infallible.

Thessalos, amongst whose pupils former cobblers, dyers and smiths are said to have been included, gave himself out as the reformer of the art of healing and was acclaimed by his untutored disciples as the incomparable physician. Possessed of undeniable talent, but

endowed with yet greater self-sufficiency, and a born charlatan, he is, in his entire behaviour and in the manner in which he flouted contemporary and earlier authorities strongly reminiscent of many disagreeable manifestations of the present day. His assertions—that no physician before him had accomplished anything useful and that the aphorisms of Hippocrates were mendacious—sufficiently characterise the man, whilst the summit of his vanity is reached with the inscription on a memorial in the Appian Way, wherein occurs the epithet *ιατρονίκης*, “conqueror of physicians.” Thessalos was, in his prime, a contemporary of Nero, to whom he dedicated his writings. These dealt amongst other things with diet, chronic diseases and surgery, whilst he also engaged in a violent polemic against his celebrated precursors, *e.g.* Erasistratos. The humoral pathologists reproached him with denying the action of drugs upon organs, such as liver and kidneys and rejected the use of bile- and phlegm-dispelling agencies on the ground that they, by their irritation, give rise to those secretions which are looked upon as *materia peccans*. It is proof of his independence that in details he differed from Themison and in general from the dogmas of the methodic school. In addition to many other services in the field of therapeutics credit must be given to Thessalos for teaching at the bedside, whither his pupils accompanied him ; in this he was far ahead of his time.

Although the theoretical premises of the methodists betoken error the rôle that this school played in ancient medicine must be judged differently and much more favourably, if their clinical capacity alone is taken into consideration. No higher praise can indeed be given them than that therapeutics as practised by rationally minded methodists has many features in common with Hippocratism, though apparently sundered from it. On the one hand their views upon the influence of Nature’s healing power, upon crises and critical days, upon the effect of a patient’s individuality on the course of pathological events—all things to the methodist unessential—constituted a rigid barrier between the two chief schools of antiquity. On the other hand they agreed in giving prominence to general treatment and to hygienic and dietetic therapy, instituted treatment in accordance with the indications and only made use of such measures as were the product of an enlightened experience, whilst rejecting all crude and superstitious procedures and materially curtailing the use of drastic medicines or operations (*e.g.* narcotics, venesection, arteriotomy, evacuants), making their employment dependent upon prescribed conditions. Although starting from contrary premises the methodists, like the Hippocratists, undertook early treatment of acute affections upon expectant lines, taking count of the individuality of the patient at least indirectly through consideration of his subjective symptoms (all kinds of topical remedies being in use) ; in the last case they often lapsed into polypharmacy, which mostly, however, extended to external applications only.

However strongly they may have disclaimed a belief in critical morbid phenomena they yet guided themselves in their plan of cure according to the stage of the complaint and in the treatment of chronic disease,

whose systematic therapy was first elaborated by the methodic school, they adhered to particular days and cycles with an exaggerated pedantry. (Terms of three days, *διὰ τρίτον*, hence also called *diatritarii*.)

Thus when Thessalos enriched the therapy of dyscrasic disease through cyclic cures brought about by metabolic change, which cures were intended to produce an agitation and transformation (*recorporatio*) of the whole body, these were nothing but a direct addition to the method (borrowed from the gymnasts) employed by the Hippocratists and known as *metasyncrasis*. This consisted on the one hand in the *cyclus metasyncriticus* or *recorporativus* (reduction cure by various degrees of fasting, ingestion of hot substances, pepper, mustard, squills, "thinning" wine; also baths, active and passive movement, massage, sinapisms, irritating plasters etc.), on the other in the *cyclus resumptivus*, which was to restore strength by stimulating diet and appropriate measures.

This method of treatment was carried out in periods of three days or in longer periods (*e.g.* eleven days), beginning according to circumstances with the first or second cycle, but at the most three times in succession.

Methodism was intrinsically incapable of further development, at most its therapeutics could be extended and improved. Thus it follows that a great proportion of its adherents relapsed into the pursuit of an unthinking routine or into a barren empiricism, whilst its more gifted exponents by means of intelligent, critical observation accumulated a mass of valuable practical experience, which under the etiquette of the system they devoted to the good of the school. It is worthy of note that several of them dealt exhaustively with the subject of surgery and, in particular, advanced that of obstetrics.

The methodic system enjoyed its greatest advantages in the golden days of Rome under the Cæsars. The methodists were admitted into the highest circles of society and contributed no little to the advancement of that social position which the entire medical profession occupied throughout the civilised world.

The methodic school attained its greatest height in the person of the most celebrated gynæcologist of antiquity, Soranos of Ephesus; his influence made itself felt throughout the middle ages and even into modern times.

MEDICINE OF THE ROMAN ENCYCLOPÆDISTS

(CELSUS, PLINY)

EVEN after the triumphs of Greek medicine the national tradition prevented prominent Romans from embracing the profession of healing and entering into competition with foreign adventurers, freed-men and slaves; to the few who overcame prejudice the stigma of treason clung. The small account in which the profession was held, however, by no means implied neglect of the art itself. On the contrary, interest in the latter grew constantly on account of its usefulness (an important factor in Roman estimation), and the extension of the thirst for knowledge, amongst the most enlightened minds, to medical subjects is shown by numerous extracts from the works of Cicero and Seneca, by the surprising hygienic observations of the architectural genius of the Augustan epoch, Vitruvius Pollio, and by the interesting collection of memoranda of Aulus Gellius.

Amongst Roman families from whom physicians sprang are particularly to be mentioned the Quinti, Cassii, Calpetani, Rubrii and Arruntii. The correspondence of Cicero with Atticus and his writing *De natura deorum* and *De senectute* are noteworthy.

The philosopher L. Annæus Seneca, a lifelong invalid, was the author of a writing *De immatura morte*, which has unfortunately perished, and he assigns with great emphasis in his letters luxury and debauch as the origins of disease, asserts the deleterious effect of excessive bathing, sweating and drug-taking, and the life-prolonging effects of moderation and fresh air.

He repeatedly lashes with bitter tongue the unprofessional behaviour of charlatans of his day; on the other hand in the noble treatise *De beneficiis* (lib vi.) he accords the highest praise to the faithful vigilant physician for whose invaluable acts of friendship the indebtedness remains even after pecuniary obligations are discharged; *pretium operæ solvitur, animi debetur*.

In the famous work *De architectura* of Vitruvius mention is made of hygienic necessities, and it is accounted in favour of a locality that it lie high, be not exposed to wind nor mist, to great heat nor great cold, and be situated far from marshes, whose poisonous exhalations exert a pernicious influence upon men.

It is an unfavourable sign of the sanitary peculiarities of a locality if the liver of slaughtered animals be frequently found of a greenish-yellow colour.

The access of daylight to the individual rooms of a house is to be regulated according to their use.

In dealing with aqueducts Vitruvius dwelt on the disadvantages of leaden pipes, instancing the diseases of workers in lead. He considered the origin of goitre to be the drinking-water of many neighbourhoods.

Gellius (b. ca. 130 A.D.) declared that a minimum of medical knowledge was indispensable even to the laity and from his store of learning derived from all domains of science he evolved memoranda upon the viability of seven months' children, upon quintuplets, abortions, upon the ominous significance of the sixty-third year of life, upon the duty of suckling, etc.

The dilettante interest in medicine was in no small degree rooted in the desire to be independent of the strangers, half wondered at, half hated, and to make use of the knowledge so acquired at home amongst relatives and friends or in the infirmaries intended for the *familia rustica*.

Just as there had long been in existence writings in the mother tongue which revealed to the cultured Roman the secrets of rhetoric and philosophy, of statesmanship, of the art of war and agriculture, so there grew the need of a corresponding medical literature, the more so since the old work of Cato no longer kept pace with the progressive spirit of the age. The difficulties to be overcome in this case were far greater than elsewhere, as the study of books alone, without practical experience, did not suffice for critical elaboration of the information acquired, even compilation and translation into Latin presenting many obstacles from lack of a technical nomenclature.

Nevertheless what the iron Roman will was capable of is proved by the admirable achievement of the writer of many histories, Marcus Terentius Varro (117-26 B.C.), whose erudite researches extended into all realms of learning and who included medicine within the scope of his activities, both in his big encyclopædia (*Disciplinarum libri ix.*) and in his yet extant treatise upon agriculture (*Rer. Rusticar. libri iii.*).

In *De re rustica* Varro gives hygienic prescriptions for the construction of country houses, reports how, upon occasion of a devastating epidemic in Corcyra, he brought help by means of ventilation, isolation of patients and rebuilding of houses. Of greatest interest is the fact that he considered, with the anticipation of genius, the cause of malaria to be invisible organisms. "*Animadvertendum etiam, si qua erunt loca palustria . . . quod crescunt animalia quædam minuta, quæ non possunt oculis consequi, et per aëra intus in corpus per os ac nares perveniunt atque efficiunt difficiles morbos.*"

Following this example A. Cornelius Celsus, probably between 25 and 35 A.D., collated the knowledge of his time in an encyclopædia conceived upon a large scale and bearing the title "*Artes*," which dealt with rhetoric, philosophy and jurisprudence, as well as the art of war, agriculture and medicine. With the exception of scanty fragments upon rhetoric, all that has survived of this is the medical portion—*De medicina libri octo*—a work that takes its place with the *Corpus Hippocraticum* and the writings of Galen as one of the chief monuments of ancient medicine (*Hippocrates latinus*). The medicine of Celsus which, with its freshness and animated descriptions, charms like a modern compendium, and which, from the

elegance of its diction, is an ornament to Roman literature, constitutes the summit of contemporary attainment ; it, however, owes its inspiration to the works of Hippocrates, to the Alexandrians and to the school of Asclepiades. Nevertheless, the independence with which Celsus arrives at decisive judgments, frequently drawing his conclusions from personal experience, impresses upon his compilation the stamp of originality. It may even be said to take the place of the lost literature of the Alexandrians. Although not a professed physician, it is an intellectual medical thinker, a model practitioner that speaks from its pages and, inspired by the noblest conceptions of his art, represents the fruits of the Hippocratic spirit in the noble setting of the Roman tongue.

The oft-raised question, whether Celsus was a physician in the strict sense of the term, answers itself in the negative after consideration of his origin and of the national prejudice of patricians against the practice of medicine as a profession, in view also of his collected writings, each one of which bespeaks the master of that particular branch of science. This explains the fact that Celsus is nowhere quoted in the medical literature of antiquity. Examination of the works themselves contradicts the assumption that Celsus was a professional physician, for he openly and repeatedly expressed his scepticism of the value of medicine, and in many places he prefers folk-medicine before scientific. Against this may be set the undoubted fact that Celsus did pursue the study of medicine practically, as well as from books, through love of it, and learnt much from his own observations. In the Middle Ages the writings of Celsus had almost fallen into oblivion, or were at least quite without influence upon the development of the art of medicine. The first, no longer extant, manuscript, from which all subsequent ones were derived, is supposed to have been discovered by the later Pope Nicholas v., in the fifteenth century. The extraordinary recognition rightly accorded to Celsus in the Renaissance times is to be explained by the fact that his work was one of the first to appear in print, even before the Galenical or Hippocratic writings, *Editio princeps*, Florence 1478.

In the introduction (*Prooemium*), masterly both in form and matter, Celsus portrays the historical evolution of medicine up to the time of Asclepiades and Themison, points out how therapeutics gradually became divided into the branches of pharmacology, dietetics and surgery, and pronounces with dignity devoid of bias or passion an impartial judgment upon the relative merits of the dogmatic, empiric and methodic schools. The section, in particular, wherein he indicates the speculative errors of the methodists is amongst the best things the neglected field of medical criticism can show.

The information at our disposal concerning the methods of investigation of the Alexandrians and the intellectual attitude of the different schools, notably of the empiric, we owe largely to the lucid representation of Celsus. He demonstrates, too, with the utmost clearness, the unusually doctrinaire and dogmatic position of the methodists whereby they lost ground in profundity of research and breadth of view. Moreover their narrowness alone was new, since Hippocrates had long before recommended recognition of similarities in disease, though not that research should remain content with this. In practice the methodists

involved themselves in contradiction, for they had, for instance, to take account of different forms of relaxation, *i.e.* of disease types, and despite their disbelief in ætiology, had to consider the influence of climate, season, etc. Their form of practice, he said, prevailed amongst barbaric races and in veterinary surgery and was popular with those who had to treat numbers in the *valetudinaria*.

The standpoint taken up by Celsus himself is a temperate one. Theory and practice together, supplementing and controlling one another, constitute the foundation of the true art of medicine. Not scientific training alone (particularly in anatomy and physiology) produces the physician, although it leads to greater achievements in his subject. "*Verumque est, ad ipsam curandi rationem nihil plus conferre, quam experientiam. Quamquam igitur multa sint ad ipsas artes proprie non pertinentia, tamen eas adjuvant, excitando artificis ingenium. Verique simile est, et Hippocratem et Erasistratum et quicumque alii, non contenti febres et ulcera agitare, rerum quoque naturam ex aliqua parte scrutati sunt, non ideo quidem medicos fuisse, verum ideo quoque majores medicos extitisse.*" It must be borne in mind that medicine is not an exact science and apparently fully established premises may, under special circumstances, prove false; speculation should occupy a prominent position in thought, but not in actual practice; "*est enim hæc ars conjecturalis; neque respondet ei plerumque non solum conjectura, sed etiam experientia . . . rationalem quidem puto medicinam esse debere: instrui vero ab evidentibus causis; obscuris omnibus, non a cogitatione artificis, sed ab ipsa arte rejectis.*"

Human vivisection is objectionable, dissection, on the other hand, necessary. "*Incidere autem vivorum corpora, et crudele, et super-vacuum est; mortuorum, discentibus necessarium. . .*" Celsus is a respecter of his great precursors, whose reputations he piously guards, without on that account doing injustice to contemporaries. "*Oportet autem neque recentiores viros in iis fraudare quæ vel reperunt, vel recte secuti sunt; et tamen ea, quæ apud antiquiores aliquos posita sunt, auctoribus suis reddere.*" This respect for authorities does not lead him into a blind belief in authority, as he repeatedly opposes, not only Asclepiades, but even Hippocrates (as in the matter of belief in critical days).

The valuable material is thus divided amongst eight books. Book I. Diet in health; Book II. General pathology, semeiosis, prognosis, therapeutic indications; Books III. and IV. Special pathology, with subdivision into general and local affections; Books V.-VIII. treat of surgical matters (of particular excellence are the descriptions of lithotomy and plastic operations) with inclusion of ophthalmology and obstetrics.

ANATOMY and PHYSIOLOGY are only taken so far into account by Celsus as practical medical purposes are concerned. Osteology is moderately well represented, the description of the skull in particular rests upon careful investigation. The individual muscles, on the other hand, are not described. Venæ frequently signify vessels in general, in other places Celsus distinguishes between air-conducting arteriæ and blood-conducting venæ. The termination "*nervi*" signifies now nerves, now muscles, now tendons.

Book I. is devoted to DIET and HYGIENE in health and disease and is based partly upon Hippocratic, partly upon methodic views, but gives evidence of the author's originality and of modification to suit the conditions of Roman life.

GENERAL ÆTIOLOGY, SYMPTOMATOLOGY and PROGNOSIS occupy the first eight chapters of the second book, mainly derived from Hippocrates, as Celsus himself says in his introduction. Like the former, he describes the influence of seasons, of weather, of age and of constitution upon the origin of diseases, and records a number of observations upon prognostic signs which remain true for all time. Of great interest is the second chapter which sets out the signs of impending illness and the sixth which gives those of approaching death as well as the enumeration of symptoms of prognostic importance in individual complaints such as consumption, dropsy, hepatic abscess etc.

The descriptions which most attract attention are those of abnormalities of the urine, of symptoms of stone in the bladder, of prodromata of insanity, of the last stages of consumption—all these come from a master-hand and are readable even to-day.

The succeeding chapters of this book contain GENERAL THERAPEUTICS and in them Celsus, with keen insight, gives credit both to the Hippocratists and to the school of Asclepiades. Thus in discussing the indications for blood-letting he refers to a whole series of objections of the older physicians, himself finding in excessive bodily weakness the only contra-indication; his directions upon the performance of venesection and his warnings against the errors of technique which may occur are excellent. In addition he recommends cupping, dry and wet, purgatives, emetics and finally the favourite methods of contemporary medicine: massage, active and passive movements, fasting and diaphoretics. In these sections the technique of as well as the indications for the above procedures are described with great care.

SPECIAL PATHOLOGY and THERAPEUTICS are described in Books III. and IV. Celsus opposes the current division of diseases into acute and chronic, distinguishing them rather as general and local. He rejects the theory of critical days and, unlike the methodists, individualises carefully, the condition of the pulse in particular giving him a measure of the physical condition and a clue to treatment, but he refers to the mistakes that may occur in its examination. Hygienic and dietetic measures are recommended also for the individual symptoms of fever, such as headache and inflammation. (Book IV. chapter 10 contains the famous symptomatological definition of inflammation: "*Notæ vero inflammationes sunt quatuor, rubor et tumor, cum calore et dolore.*") Of the greatest importance is the 18th chapter of Book III. in which the therapeutics of mental disturbances are discussed, Celsus not only giving indications for the methods commonly in use, but laying chief stress upon psychical treatment.

The masterly description of SURGERY takes up the whole of Books VII. and VIII., in addition to which many surgical observations are scattered throughout the remaining books. Celsus mainly follows Hippocrates, but his work, including as it does all the most striking advances of the subsequent period of over four hundred years, forms an invaluable source of knowledge of the achievements of the Alexandrian school in particular.

Celsus discusses injuries and their characteristic symptoms, the attitude of injured limbs, the different natures of wound-secretions, arrest of hæmorrhage and treatment of wounds, treatment of fractures, dislocations, caries and necrosis of bones, fistula, fissure, ulcers and tumours, herniæ etc. More or less minute descriptions are given of trephining, resections, am-

putations, radical operation for umbilical hernia, operation for phimosis, urethrotomy, etc. Arrest of hæmorrhage is effected by means of tamponage and compression or by ligature of vessels. Ligature, not mentioned in the Hippocratic writings, is thus spoken of: "*venæ quæ sanguinem fundunt, apprehendendæ, circaque id quot ictum est, duobus locis deligandæ.*" As a dressing for wounds a sponge wrung out of vinegar, wine or water was used and fixed by means of a linen bandage. Suture was employed to promote union of wounds. In penetrating abdominal wounds and intestinal injuries, Celsus recommends suture of the intestines, and in suture of the abdominal wall recommends inclusion of the peritoneum. As regards new growths Celsus was familiar with the recurrence of carcinoma even after removal with the knife.

As by Hippocrates strangulated hernia is not clearly described, nor is there any lucid account of radical operation for hernia. On the other hand the Roman author describes trusses, and translucence as a sign of hydrocele. Amputation was only undertaken for gangrene and that at the line of demarcation. Notable contributions are the descriptions of lateral lithotomy and plastic operations. Diseases of the mouth, nose and ear are carefully described from the standpoint of contemporary knowledge.

In these branches there are noteworthy descriptions of aphthous ulceration and croupous conditions, of operative treatment of cancer of the lip, of tonsillar hypertrophy and nasal polypus, whilst Celsus also gives an excellent account of *ozæna* and lays stress upon the spread of inflammatory affections of the ear to the brain. In the technique of otological treatment instillations and syringing with the "*Clyster oricularis*" played a prominent part; foreign bodies were removed by means of a probe tipped with wool and saturated with turpentine, by syringing and sternutatories.

In DENTISTRY it is of interest to note that, to facilitate extraction the gum was loosened all round the tooth; in the case of very hollow teeth, in order to obviate breaking, the cavity was previously filled with unravelled linen and lead. Loose teeth were bound with gold thread to their neighbours and, under certain conditions, an attempt at stopping was even made.

The following points may be mentioned in reference to OBSTETRICS and GYNÆCOLOGY. Celsus recognised the difference between the male and female pubic arch, was familiar with the hymen and vicarious menstruation, recommends rectal examination, catheterisation, and the cross-bed position in obstetric operations.

Throughout Celsus insists upon the dangers of the puerperal state and the necessity of practice in obstetric manipulations.

In OPHTHALMOLOGY a good description is given of the operation for cataract, the first extant in literature: the procedure laid down, resting on false anatomical premises, remained in general use until the eighteenth century (depression).

Although the work of the Roman Hippocrates was actually intended for use by the laity (*i.e.* for those not professed physicians), yet he had in his mind those who turned their knowledge to practical account. Hence it causes no surprise to find in his works many aphorisms bearing upon medical politics and deontology. Many of these are to be reckoned amongst the pearls of medical ethics, like that in which, referring to the father of medicine, he says that the truly great physician does not conceal errors committed, "*magno ingenio, multaue nihilominus habituro, convenit etiam simplex veri erroris confessio; præcipueque in eo ministerio, quod utilitatis causa posteris traditur; ne qui decipiantur eadem ratione, qua quis ante deceptus est.*"

Of far less intrinsic value than the work of Celsus is the world-famous "Natural History" of C. Plinius Secundus (23 to 79 A.D.) which for several centuries was the oracle of science and, on account of its extraordinarily voluminous pharmacological contents, served as a mine of information for the physicians of the past, whilst for us as an invaluable source of historical information it takes the place of countless writings which have been lost.

Since Pliny, like Cato, held Greek physicians in small esteem and hence drew no hard and fast line between scientific medicine and the different forms of crude empiricism, he included without criticism everything from which he could in any way derive information. Thus his work, evidence of astounding industry, presents us with a life-like picture of ancient popular medicine, the innumerable fantastic, often supernatural methods of which originated in the intermingling of Græco-Italian with oriental civilisations and which, in the course of time spread over the whole of Europe where, with numerous local modifications and mingled with native customs, it has tenaciously held its own till the present day.

FORMULÆ AND MATERIA MEDICA

THE growing luxuriousness characteristic not only of the decadent republic, but even more so of the imperial era, bred an effeminacy which obscured that therapeutic tendency the keynote of which was dietetic treatment, almost to the exclusion of drugs. The refinements of a self-indulgent civilisation brought to the bed-side by ignorant, time-serving and avaricious practitioners, found their expression in over-zealous interference and polypharmacy, which were based upon the most unenlightened empiricism and which played upon folly and superstition. In this period, when extreme scepticism was found side by side with the most childish credulity, the highest position in medicine was attained by him who prescribed the rarest drugs and the largest number of them, or who had at his disposal secret and strange remedies, particularly if obtained from foreign countries. Daily the number of drugs increased, brought by trade to the centre of the Græco-Roman world—but these were a poor substitute for fresh ideas.

Such a condition of affairs was necessarily reflected in the literature and popular formularies. These, devoid of all scientific value, merely pandered to fashion, only aided routine, but with a semblance of practical utility they acquired a reputation at least in the eyes of the unreflecting masses. Many of these works even aspired to poetic fame, their uninformative contents, following a curious taste of the age, being presented in metric form. There was, however, amongst the physicians a minority which strove scientifically to investigate drugs, to test the real value of simple substances, to bring order into the chaos of an unregulated terminology, to define methods of preparation and dosage, and thus actually to improve the art of therapeutics. Most authors, on the other hand, spurred by greed of gain or false ambition, only added to the number of compounds, of antidotes, and of strange panaceas, which they endowed with poetical names. Such authors hardly deserve the name of pharmacologists, yet their formulæ traversed the centuries in literature and became to a great extent permanent constituents of the edifice of medicine.

Examples of these are the anodyne antidote of Philon of Tarsus, the

opium-containing "Philonium" or the "Theriacum" of Andromachos, body physician to Nero, a universal antidote compounded of over sixty ingredients, which, in many modifications, held its place down to the threshold of modern times.

Amongst the more meritorious productions may be reckoned the *Compositiones medicamentorum* of Scribonius Largus, a medical pocket-book containing 271 formulæ, arranged according to the parts of the body from the head to the feet and published about 47 A.D. with a dedication to the Emperor Claudius. The author, in addition to his personal experience, made careful use of earlier work, from which he took much that was of value, but he was not averse from including within the scope of his industrious compilation popular remedies of a fantastic and magical nature. It is an interesting fact that Scribonius Largus was the first to describe accurately the method of obtaining opium and recommended the application of the electric ray for severe headache (? the first use of electricity in medicine).

Scribonius Largus owed his very extensive practice principally to the circumstance that he fostered with enthusiasm treatment by drugs, which method, following Herophilos, he defended against the orthodox adherents of an exclusively dietetic therapy. Brought to court by the influence of a powerful patron (the freedman Julius Callistus) he treated members of the Imperial family (*e.g.* Messalina) and accompanied Claudius on his expedition to Britain. This journey, like every other opportunity, he utilised in extending his knowledge of medicaments and in adding to his collection of formulæ. Standing alone in the domain of uncritical empiricism, he not only collected from Greek literature numerous medical formulæ which had been there recorded, but also obtained, by means of heavy bribery, many celebrated secret remedies from physicians, dilettanti and quacks of the health resorts. The *Compositiones*, which have come down to us, contain therefore, in addition to rational prescriptions, popular and magical formulæ. Occasionally he gives a hint of the possession of clearer insight and critical faculty, but these occasions are rare. Explanations of the action of medicaments are sought in vain, whilst he excuses himself for the failure of his compounds upon the ground that varying bodily structure, age, time or place are capable of exercising influences not to be determined beforehand. Nevertheless there is, particularly in the introduction to the little work, a strain of conscientiousness which evokes sympathy, and which is in keeping with his eloquent lament over the moral and intellectual decline of his contemporaries.

The true scientific spirit is only to be found in one of the numerous pharmacologists of this era, Pedanios Dioscurides who, from adolescence onwards, brought unflagging interest to bear upon the subject and drew his inspiration not only from the achievements of his predecessors, but also from his own observations. Dioscurides of Anazarba in Cilicia was, in Nero's time, serving as a surgeon in the Roman army, and utilised the botanical and pharmacological knowledge acquired in his visits far and near for his book upon *materia medica*, published in five volumes

shortly before 77 or 78 A.D. This work ranked incomparably higher than any other of its kind for completeness, critical insight and carefulness of description, and for a long time was unsurpassed.

Dioscurides, free from the dilettantism or dogmatism of most of his predecessors, trusting to accurate facts alone, attained in a wonderful measure the object at which he aimed. This was the simplification of the therapeutic art and the limitation of polypharmacy within reasonable bounds by an exact terminology, by accurate description of remedies in all three kingdoms, and by reliable data upon their preparation, preservation, testing, employment, dosage and action. Stress is naturally laid upon remedies derived from the vegetable kingdom; in a special chapter each individual plant is described *in toto*. Name, synonym and order precede pharmacological and pharmacodynamical data, and the excellence of Dioscurides' botanical descriptions is shown by the fact that, notwithstanding the inherent difficulty, most of the plants depicted can be recognised at the present day. Salient facts are that he was familiar with all the plants possessed of healing virtues native to Arabia and that his works contain the first reference to the chemical preparation of metallic agents (only used externally). He held himself as far aloof from superstition as was possible, considering the spirit of his day, and with such advantages it is no matter for surprise that Dioscurides should have maintained his pre-eminence into recent times and in the East is still looked upon as an oracle.

PNEUMATISTS AND ECLECTICS

THE dogmatic sects which owed their origin to the Alexandrian school of medicine maintained their position in Rome also, but it was a mere shadow of existence that they dragged on, in competition with the victorious methodic and the old, but ever rejuvenescent, empiric systems. The stereotyped meddlesomeness of the age threatened, not only speculation upon the phenomena of disease, but medical thought as a whole, with decay; nor, in the absence of exact methods of investigation, was any satisfactory advance in theory to be expected either from one-sided humoral, nor from its antithesis, solidist pathology.

Following upon the decline of the platonic and peripatetic schools philosophy had found itself in an exactly comparable situation until the Hellenic renaissance through the stages of scepticism and atomism reached the standpoint of syncretic stoicism. This, resting on the sure foundation of the past, even if inclining strongly to the practical side of life, yet gave fresh impulse to stagnant idealism and metaphysics.

Following this example, and in immediate connection with the Stoa, the system held in highest esteem by the Romans, there arose in the first century A.D. a small body of scientifically-minded physicians who strove to introduce a new development of medical theory. Their aim was to apply the pneumatic doctrine, the fundamental idea of stoic philosophy, to physiology and pathology and thus, from this new standpoint, to reconcile two hitherto divergent lines of thought. Athenaios of Attaleia (Pamphylia) was the founder of this school, which at its inception was rightly named the "Pneumatic" (*πνευματικοί*), since it insisted upon the derivation of all organic phenomena from the action and condition of the "vital air."

As the determining influence of therapeutics upon thought made itself felt, however, this school became converted into that of the "Eclectics" (*επισυνθετικοί*), likewise a counterpart of stoicism, which from the first had displayed a syncretic tendency. Medicine in antiquity had often sought illumination from philosophy, but the historical connection between the two and the harmony in their subsequent evolution were

never more apparent than now. On the other hand, if the genesis of medical theory, free from external influences, be considered, it must be admitted that it was the pneumatic school which fully developed the ancient conception of "vital air." This conception lay inherent, but little regarded, not only in the medicine of the oriental Egyptian school, but also in that of the nature-philosophers and Hippocratists (cf. Diogenes of Apollonia, Heracleitos, the Hippocratic books, *περὶ φύσων, περὶ φύσιος ἀνθρώπου*, Anonym. Londin. cap 5), and even in that of Erasistratos and Asclepiades, (*λαεπτομερές*).

The stoic doctrine, founded by Zeno of Citium (in the last decade of the fourth century B.C.), of which Chrysippos of Soli in Cilicia was the chief literary exponent, stood for the philosophy typical of Hellenism and for a compromise between the various antecedent systems (particularly those of Heracleitos, Plato and Aristotle). From its eclectic basis, from its practical tendency and, last but not least, from its cosmopolitan standpoint, this reached its highest development in the Roman Empire, although taking the form of a popular moral philosophy. The stoic system of metaphysics is dynamic and material with a strong teleological bias. In agreement especially with Heracleitos and with the Aristotelian duality of an active and a passive principle the stoics acknowledge one single world-power (God) who is conceived on the one hand as being world-reason, and on the other is identified with original matter, fire, breath of life or *pneuma*. *Pneuma* is at once the original matter from which all individual things have emanated, and the all-pervading, all-ruling and creating world-reason (*λόγος σπερματικός*). Since *pneuma*, as embodiment, works from necessity, but as spirit, with design, the process of nature can lead only to perfect and teleological results. In accordance with the identification of primitive force with primitive matter, so in each individual thing, despite the logical distinction between an active and a passive principle, the moving force is identified with the matter upon which the influence is exerted, with the conclusion that "only the material is real." Thus the human body, formed by design out of crude elements, is throughout pervaded by the warm breath of life, which, as an emanation from the world-soul, constitutes reason, brings forth speech, imagination, desire, is the vital spark that supports all physiological functions and which has its chief seat in the thorax.

The stoic view of the world was taken from a biological standpoint—the world as an organised, be-souled, reasoning, creative and reproductive entity—and the stoics were fond of dealing with medico-physiological questions, pursuing their investigations into nature from the narrow point of view of anthropomorphic teleology. It was but natural therefore that their teaching should exercise a predominant influence upon medical theory. This result only came to pass, however, after the collapse of epicurean atomism with Asclepiades and as a sequence of growing dissatisfaction with degraded methodism. It was not merely through their pneumatic doctrine and teleology, but also in matters of form, by their subtle differentiations, logical and dialectical (particularly in causal thought), that the stoics exercised their influence upon the pneumatic school and thereby upon the entire further development of medicine.

In contrast with the methodic system the doctrinal edifice of the pneumatists was built up on a foundation of carefully thought out physiology in which the chief part is played, in addition to the *pneuma*, by the four elementary qualities of the older dogmatists as well as by the doctrine

of pulmonary and cutaneous respiration (cf. here in particular the Sicilian school and Diocles).

The fundamental constituents of the body (as with the older dogmatists) are warm, cold, dry and moist, qualities which, taken as matter, build up the tissues and organs, taken as forces, condition the vital processes; the warm and cold rank as active powers, the dry and moist as passive. The supreme control of physiological phenomena is the function of the vital principle, inherent in man's nature which, by its manifold movements, calls forth internal warmth and in a threefold gradation first holds the body together; secondly as formative power brings about growth and procreation; finally produces thought, sensation and desire; the ruling portion of the soul is the *ἡγεμονικόν* with its seat in the heart (cf. the Sicilian school). The respiratory process serves the purpose of replacing pneuma by inflow of air and of moderating the inner warmth. Contraction of the thorax causes air to enter, expansion expels it when impure. This end is further served by the perspiration (*διαπνοή*), *i.e.* the pulsatory activity of the arteries, through the ultimate ramifications of which in the skin the supply of air for the body takes place (in systole), whilst the foul air is eliminated (in diastole). Blood is formed in the liver by means of its inherent warmth from the nourishing parts of food, and from the liver is led to the heart; the spleen serves as a purifying organ.

The arteries springing from the heart, as well as the veins originating in the liver, convey blood as well as pneuma, but with this difference, that the former contain more pneuma, the latter more blood.

Voice and senses are considered as functions of the pneuma; each of the sense organs possesses a peculiar pneuma, *e.g.* the eye a very delicate one, the ear a dry one, the nose one which is moist and vaporous. Procreation presupposes an active and a passive principle, *i.e.* the male element (with its motive and formative power), and the female element (material for the construction of the embryo). The ovaries produce no real seed but, like the breasts of the man, are only present in analogy, but without *ἐνέργεια*. Males arise from the right (warm) side of the uterus, females from the left.

Health depends upon the normal condition of the pneuma, and is promoted by its tension (*τόνος*). (This tone is to be appreciated by means of the pulse.) Sickness is disorder of the pneuma caused by faulty constitution of the elementary qualities, of which dyscrasiæ there are eight in all, according to the abnormal preponderance of one quality or of two (*e.g.* of coldness and moistness). The nature and gravity of the illness depend upon the degree of disturbance of the pneuma.

In their special pathology the pneumatists made extensive use of dyscrasiæ, whilst, however, laying chief stress upon the corresponding morbid agent, *i.e.* one of the four cardinal humours (blood, phlegm, yellow and black bile).

This can be best followed out in the pneumatic doctrines upon fever: quotidian fever depends upon cold and moistness, is therefore brought about by the cold-moist humour, *i.e.* excess of phlegm; tertian fever depends upon warmth and dryness, its morbid humour is yellow bile; quartan fever has black bile as its morbid humour, corresponding with cold and dryness. (In spite of their practical conformity with the humoral pathologists, the pneumatists looked upon phlegm, yellow and black bile, not as primary causes of disease but only secondarily as morbid matter.) There was no complete harmony amongst authors

in regard to the classification of disease according to qualities. The special peculiarities of individual disease-manifestations were, in regard to their incidence, deduced from the system of correspondence of qualities, *e.g.* cold-moist quotidian fever, in keeping with its quality, occurs most commonly in winter, when the air is cold and moist, in cold and moist localities, and in old age; tertian fever (warm-dry) in young persons, in summer-time, in hot and dry neighbourhoods; quartan (cold-dryness) in autumn, and so on.

Fever arises from corruption of the cardinal humours (σῆψις τῶν χυμῶν), a doctrine long upheld by the older dogmatists, and which, from this time onwards, was long found in medicine. (Asclepiades and the methodists had rejected the conception of corruption as well as that of a digestive process; they believed only in obstruction to the pores and reduction to atoms.) In the doctrine of disease investigation is necessary not alone into the apparent causes (φαινόμενα), but also into those which are hidden and invisible (ἄδηλα). Following in the footsteps of the stoics the pneumatists in their ætiology distinguished with hair-splitting subtlety a graduated series of causes of which the following are the most important varieties. Αἷτια προκαταρκτικά are causes of extrinsic origin (*e.g.* over-eating). From these arise the αἷτια προηγούμενα (*e.g.* over-filling of the vessels with blood due to excessive indulgence in food—plethora). Αἷτια συνέκτικα stood for intrinsic, continuous causes whose presence, increase, decrease or disappearance determines the corresponding stages of the disease (*e.g.* stone in the bladder). Theoretical distinctions were also made between the disease-processes: αἰτία (the exciting cause), διάθεσις (concerning the state of the illness), νόσος (the dyscrasia), πάθος (disturbance of function), and σύμπτωμα (results of disturbed function).

Diagnosis received a special refinement at the hands of the pneumatic school through the fact that pulse-lore, founded by Herophilos and of particular importance to their system, was developed by them with dialectic subtlety. Their therapeutic system was, in accordance with their pathological premises, directed towards combating the dyscrasiæ, excessive warmth being encountered with cooling remedies, excessive cold with warming, excessive moisture with drying and excessive dryness with moistening ones. The adherents of the pneumatic school, however, differed characteristically from the humoral pathologists in this, that the former endeavoured to relieve abnormal combinations of qualities far less by drugs than by physical and dietetic treatment (influence of methodism). It was herein that their best work was done, for, with great intelligence and independence, they turned to account the experience upon dietetics, bodily exercises, baths, mineral springs etc. presented in the Hippocratic writings. These methods had been handed down by the older dogmatists (cf. Philistion, Mnestheos, Dieuches, Diocles) as well as by the Alexandrians,

and since the rise of Asclepiades and the methodists, had been the chosen domain of therapeutists. The theoretical and practical principles—defended by their adherents as the only correct ones—had been already laid down by Athenaios (the founder of the school) and disclosed the fact that the pneumatic school possessed an eclectic character even in its origin, holding fast to tradition whilst showing itself to be a blending of methodism with rejuvenated dogmatism. This character was perpetuated by the disciples of Athenaios :—Theodoros, Magnos, and in particular Agathinos.

Athenaios practised at the time of Claudius—Celsus was not acquainted with the new sect—he attracted a considerable number of adherents in Rome, and acquired a great reputation, both during his life and after his death. With a keen eye for the faults of his day and well equipped with an exhaustive knowledge of philosophical and medical literature, as well as practical aptitude, he attempted to reform the prevailing abuses in his profession. Acting upon the opinion that instruction in medicine should constitute an essential part of the education of youth, that every man should be a physician, since medicine was necessary in every calling, he published, in addition to “Definitions,” a work in at least thirty volumes, covering the entire range of his art, which was notable for clearness of exposition. Unfortunately nothing remains but extracts from later works, dealing with dietetics, physiology, embryology, pathology and hygiene. It is of particular interest to note that he carefully analyses, from the scientific standpoint of his day, *i.e.* according to the principles of the doctrine of qualities, food-stuffs (cereals, breads), drinking-water (filtration through soil), influence of air (in the sun, in the shade, by day, by night, in town and country, in high, in woody country, in the neighbourhood of streams, on the sea-coast, inland, in marshy country), and laid down detailed rules of life for every age, for both sexes, for different seasons. In the education of youth he laid great stress, following Plato, upon simultaneous development of body and mind, recommended that the earliest instruction should be, to a certain extent, imparted in play, without excessive severity, and that, even after the twelfth year, when the more strict scientific instruction should commence, the greatest attention should be paid to bodily exercise, partly to suppress the growing sexual feelings. The intellectual education of women should be mainly centred upon acquiring knowledge of housekeeping. Athenaios counselled women in the interest of their health to occupy themselves with domestic affairs, recommending them to supervise personally the baking, personally to assist in the household, to superintend and distribute necessary supplies, personally to knead dough and make beds, since bodily movement improves the appetite and produces a healthy complexion. In therapeutics Athenaios followed Asclepiades, although differing from him in many details.

Claudius Agathinos of Lacedæmonia (under the Flavians) rightly named the school eclectic, since he strove to bring it into yet closer touch with the empirics and methodists. He devoted unusual industry to the favourite subjects of his master, particularly to the study of the pulse (*περὶ σφυγμῶν*), experimented upon dogs on the action of hellebore, and, whilst not entirely rejecting the use of warm baths, he gave preference to cold ones, for the use of which he drew up fixed rules.

After Asclepiades and Antonius Musa, the use of cold baths was brought into favour, particularly by Charmis of Massilia, a physician of Nero's time, and was fanatically defended both in and out of the profession. Agathinos recommended it for children and at every age.

Amongst the most prominent adherents of Agathinos may be reckoned Herodotos and Archigenes of Apameia (in Syria).

Archigenes lived in Rome at the time of the Emperor Trajan. The universal judgment of his contemporaries as well as of later critics ascribes to him those qualities the possession of which his reputation for learning and practical ability would imply. To him, personally, the school was indebted for its ever-increasing recognition and, apart from the praise of later writers, the eminence of this medical investigator is emphasised by the fact that the great Galen in after times drew much upon his writings, which inspired him to similar scientific labours. Archigenes, whilst enjoying widespread popularity, especially amongst the great, yet found leisure for considerable literary activity, striving to present in popular fashion, though with all subtlety of logical distinction, the fundamentals of the pneumatic theory and to bring them into harmony with the best of empiric and methodic medicine. In addition to letters of medical advice he was the author of works upon the pulse, upon feverish ailments and fever types, upon local affections, upon diagnosis and treatment of acute and chronic diseases, upon the right moment at which to operate, upon surgery, drugs (especially hellebore and castoreum), and therapeutic measures in general.

The fragments which are extant convey the impression of an exceptional therapist, highly gifted also as a surgeon, who made cautious use of every means at his disposal, even employing methods of superstition (*e.g.* amulets), doubtless from a suggestive point of view. It is noteworthy that Archigenes raised the study of the pulse to the highest point to which antiquity could attain, that he distinguished between a whole series of varying painful sensations, from the nature of which he sought to determine the seat of disease, and that he endeavoured sharply to divide primary phenomena of disease, from those which were merely secondary and sympathetic.

Archigenes, son of a physician, Philippos, who was renowned as a pharmacologist, was amongst the best authors of antiquity, although undoubtedly to a great extent dependent upon his predecessors. Although one of the fashionable physicians of his day, who pandered to the great ladies to the extent of providing them with hair-dyes, his name is nevertheless free from any taint of quackery. Where the caustic Juvenal speaks of physicians he names him; his name with the poet is the appellative for "Physicians." In his doctrines Archigenes differs considerably, at any rate in details, from the earlier exponents of the pneumatic theory. Fever he considered due to an abnormal increase in warmth and dryness (with Athenaios it is warmth and moistness). Fevers are divided into three diagnostically separable varieties, viz. one-day fevers, septic and hectic, according to the situation of the corruption in *pneuma*, in fluid, or in solid parts. According to their course they are known as intermittent or continued.

Archigenes borrowed from Hippocrates the long discarded doctrine of critical days, but ascribed a greater importance to the 21st day than to the 20th, to the 28th than the 27th. His teaching concerning the pulse constituted his greatest achievement. By σφύγμεις he understood the normal movement of arteries and heart and held both systole and diastole to be manifestations of active force. Like Herophilos Archigenes assumed four phases (systole, diastole and the two pauses) and distinguished ten chief varieties of pulse with corresponding sub-varieties. Size, rapidity, strength, fulness, tension, frequency, rhythm, regularity are examined in sequence. Archigenes gave an excellent description of leprosy and was familiar with diphtheria.

The pneumatic school also attained considerable distinction in surgery, the most renowned surgeons of the imperial age belonging to it—Archigenes, Leonidas and Heliodoros, as well as the later Antyllos.

Archigenes distinguished himself by extending the knowledge of the site of election for amputation (as opposed to the Hippocratists) and made use of ligature of vessels or torsion; he operated in cancer of the breast and uterus, employed the actual cautery to arrest hæmorrhage, as well as for coxalgia, and made use of the vaginal speculum. Heliodoros bequeathed, as fragments show, meritorious communications concerning operations upon abscesses, upon injuries of the skull (probing, trephining), exostoses, empyema, hypospadias and treatment of stricture. He undertook resections, was familiar with flap-cutting, and describes in detail different bandages (roller bandages, split and sewn bandages) and methods of reposition (with the hand, with the appliances of daily life, with instruments etc.).

Leonidas of Alexandria (about the end of the first century) modelled himself mainly upon Philoxenos, improved many operation-methods, *e.g.* amputation, flap-cutting and operation for hæmorrhoids (with aid of a rectal speculum) and, as fragments show, he investigated the subject of fracture of the skull as well as the treatment of tumours, hernia and fistula; he also was familiar with the fact that *filaria medinensis* was endemic in India and Ethiopia.

ARETAIOS, RHUPHOS, SORANOS

THE spiral curve of historical development led medical thought unfailingly back to rationalism, albeit upon a higher plane, and the pneumatic-eclectic school only implies a renewal of the fundamental principles of dogmatism, the humoral pathology contained in them being amplified by the pneumatic doctrine, veiled by the theory of qualities and considerably modified by the inclusion of all theoretical and practical advance so far achieved.

A logical reconstruction of history would require as a further stage a complete return to Hippocrates himself, who instigated the dogmatic search for a rational foundation on which to base the rules of his art. It would further presume the existence of a man whose thoughts and acts alike represent the asymptote to an Hippocratism, modified to suit the times and resting upon a scientific basis.

The ideal and the real do, in this epoch, actually coincide in a few masterpieces, of the much discussed author of which we unfortunately only know this—that he made no deep impression either upon his own or upon subsequent ages—to judge from the very scanty quotations of later authors.

These works, luckily extant, are the books of Aretaios of Cappadocia: “Upon the causes and characteristics of acute and chronic diseases” (*περὶ αἰτιῶν καὶ σημείων ὀξείων καὶ χρονίων παθῶν*), and “Upon the treatment of the same” (*περὶ θεραπείας ὀξείων καὶ χρονίων παθῶν*), writings of imperishable value, monuments of the lofty Hippocratic spirit.

Since Aretaios makes mention of no medical author other than Hippocrates and he himself made little or no impression upon antiquity, his life is only matter for conjecture, founded mainly upon the contents and style of his writings. The fact that he ascribes an important rôle to the *pneuma* has, amongst other circumstances, led to the assumption that he lived in the second half of the first century A.D. The Ionic dialect in which he wrote indicates, according to philologists, the second century. A question has lately arisen as to Aretaios' standing as a physician, which has become debatable through the discovery of a remarkable and hitherto unnoticed accordance between his works and the fragments of Archigenes of Apameia, discussion turning upon the point whether Aretaios is to be considered only as a “stylist,” who derived his knowledge from Archigenes, or whether the latter is to be regarded as a plagiarist. The notable originality with which Aretaios treats even matters of everyday knowledge makes medical historians disinclined to belittle

his fame. Whatever the final judgment may be, one thing stands out as certain—after Hippocrates, no single Greek author of whom we have knowledge, has equalled Aretaios, and no work in the entire literature so nearly approaches to the true spirit of Hippocratism, both in description of disease and in therapeutic principles, as the work of the Cappadocian.

It stands to the credit of Aretaios that, undistracted by hair-splitting scholastic dogmas and dialectics, he does not sacrifice medical experience, attained by keen observation and temperate judgment, upon the altar of specious theory. A true child of his age, but in no sense a slave to its traditions, in the midst of a morbid hyper-civilisation, surrounded by frivolous routine and extravagant speculation, he trod the strait path of true, thoughtful, critical observation of nature, a path too difficult for the multitude, marked out by the great genius of Cos apparently only for the elect of all ages. Vividly reminiscent of Hippocrates in his concise, elegant and finished portraiture; a pattern in his conception of medical duty, in fidelity of description, in reservation of judgment; inspired with the intellectual nobility which raises Greek classical literature above that of all other nations, Aretaios drew a series of pictures of disease difficult to rival, hardly to be excelled. He ever strove after more certain diagnosis, ever kept in view one chief aim—a simple method of treatment, as far as possible in conformity with nature.

Of the mass of material reference will here only be made to such writings as stand out in contrast against the teachings of the reigning schools and show evidence of advance in practice.

Aretaios looks upon the *ζύσις* as the sum-total of organic forces, considers the heart as the centre of inherent warmth and credits the *pneuma* with important functions; the *ρόνος* (cf. p. 225) is the connecting link of the organism. Diseases arise from anomalies of juices, of inherent warmth or of tone. In the descriptions of individual diseases, divided into acute and chronic, pathognomonic symptoms are described with an attractive fidelity to nature, whilst, in addition to ætiology and incidence (of age and sex), anatomical conditions frequently find suitable consideration. Particularly successful are the descriptions of pleuritis (with empyema), pneumonia and phthisis (with hæmoptysis), asthma (in the wider sense), paralytic conditions (apoplexy = paralysis of intellectual activity, of sensation and movement; paraplegia = paralysis of sensation and movement; anæsthesia = paralysis of sensation), tetanus (emprosthotonus), epilepsy (with antecedent aura), hysteria (also in men), headache (migraine), certain throat affections (amongst them diphtheria), diabetes (the first systematic description in European literature), icterus, dropsy, gout, sciatica, dysentery, various disease of the intestines, liver and bladder, spermatorrhœa and leprosy (from personal experience).

The fact that paralyses of central origin are crossed, whilst those of spinal origin are not, was clearly distinguished and received a physiological explanation.

Special stress is laid upon diagnosis and in one place (*De caus. et sign. acut. ii. 3*) auscultation of the heart is hinted at.

Aretaios added to the physiological and pathological views of the Hippocratists fundamental principles derived from the pneumatists and methodists and, in accord with the Alexandrian masters, took his stand upon a foundation of anatomy. Many of his assertions concerning intestinal ulceration, renal affections, "inflammations" or "dilatations" of the great vessels would seem to indicate that post-mortem examinations were undertaken. The point, however, is obscure, since the inconsistencies in anatomical knowledge are so startling, for Aretaios implies on the one hand a familiarity with the tubules of the kidney, the ramifications of the portal vein and of the bile ducts, whilst on the other, nerves, tendons and ligaments are classed together in the traditional manner, and even migration of the uterus assumed.—In the physiology of digestion, circulation and respiration the position of Aretaios resembles that of the pneumatists: he endows the individual organs with powers of attraction and the heart with the capacity of drawing poisonous materials from the stomach, ulcers of the lung etc. It is noteworthy that Aretaios credits the heart with far greater pathological importance than any other authors, and syncope, which he describes admirably, he considers to be a cardiac affection. In proof of this he adduces the fact that in those who fall to the ground in a faint, a small and weak pulse, cardiac bruit (*πάταγος*) and palpitation may be observed. It may here also be mentioned that he occasionally speaks of a species of tapping of the abdomen with the hand—that is, of a variety of percussion. Of infectious diseases Aretaios enumerates bubonic plague, diphtheria, perhaps also epidemic meningitis, dysentery and cholera nostras.

As would be expected in the matter of therapeutics, to which he devoted a special book on account of its importance, Aretaios is guided by experience, rejecting subtle theorising. His chief attention is directed towards careful regulation of the mode of life, making use of only a small number of remedies, mostly mild in their action. Where energetic interference is indicated he makes use of opium, of emetics and purgatives, of blood-letting (venesection on the dorsum of the hand, arteriotomy, leeches, cupping), of stimulants (cold affusions, wine, castoreum), vesicants, actual cautery, stimulating salves and inunctions. It is interesting to note that Aretaios recommends the insufflation of powder in affections of the larynx. From the ethical standpoint the fact should not be lost sight of that Aretaios, herein widely differing from the Hippocratists, does not consider that the physician was relieved of his bounden duty by the incurability of disease, though nothing might be possible to him but the expression of his sympathy.

Another physician, from whom due recognition was long withheld, takes his place in the front rank of eclecticism, his chief characteristics being unbiassed clinical observation and anatomical mode of thought.

This was Rhuphos of Ephesus, who received the groundwork of his education in Alexandria and is supposed to have practised in the reign of Trajan, therefore at the commencement of the second century A.D. Of his numerous works but few have survived, but from the remains, as well as from quotations and fragments handed down by tradition, it can be deduced with certainty that Rhuphos was an industrious worker in anatomy, materia medica and dietetics, in diagnosis, pathology and therapeutics, not only of internal but also of surgical affections. He laboured in the spirit of Aristotelian philosophy, not only industriously studying the literature, but also investigating on his own account.

Rhuphos bequeathed to posterity an anatomical work intended for beginners "Upon the naming of the parts of the body," which is of great value to the historian of anatomical nomenclature. According to his own statement his knowledge was derived from the dissection of monkeys, and he complains that in his day investigation was confined to animal dissection, with at most demonstration upon surface anatomy in slaves, whereas in earlier times human bodies had been dissected for teaching purposes. He first described the chiasma, was familiar with the capsule of the lens, and foreshadowed the difference between sensory and motor nerves; he also ascribed to the nervous system, not only the linking of sensation and movement, but the direction of all functions.

The book "Medical Questions" shows what refinement the physicians employed in their diagnosis. The doubtfully genuine "Study of the Pulse" mostly follows Herophilos, discusses the position and movement of the heart, the variation of the pulse with age and in disease, and distinguishes many kinds of pulse according to rate, strength, volume and condition of arteries, characteristic forms described being, for instance, the interrupted (*παρεμπίπτων*), the ant-like, formicans (*μυρμηκίζων*), the dicrotic, the worm-like, vermicularis (*σκαλινκίζων*) etc. In relation to urinary diseases, described by Rhuphos in a special work, it should be mentioned that at the commencement of renal inflammations he employed no diuretics, but warm enemata; that in inflammation of the bladder in men he forbade the use of the catheter, and enjoined a mild and soothing treatment (poultices, baths, enemata, suppositories, pressure over the bladder); he also described vesical hæmorrhages, paralysis of the bladder, vesical calculus (bimanual examination), prostatic abscess (as a tumour) and recommended treatment for these conditions mostly of a practical character. He is amongst the earliest authors upon bubonic plague, leprosy and condylomata; he described traumatic erysipelas, epithelioma, tumours of tendons (pressure in the treatment of ganglion) and traced the dissemi-

nation of Guinea-worm to impure drinking-water. A detailed description of an improved Hippocratic extension bench and a description of the means of arresting hæmorrhage (digital pressure, pressure with bandages, cold, astringents, torsion and ligature, severance of incised vessels) speak for his surgical capacity, as well as the mention of traumatic aneurysm. He also devoted his energies to gynæcology (dysmenorrhœa, diagnosis and hygiene of pregnancy). Finally Rhuphos enriched hygiene by many rational maxims of wide application, advanced psychiatry and invented a whole series of medicinal compounds, one of which, his Hiera (a colocynth-containing purgative) attained particular fame.

The rise of the pneumatists and eclectics did not by any means entail the downfall of the methodists, on the contrary, the last school flourished supreme, and in the reigns of Trajan and Hadrian received a great impulse through one of the most famous of physicians, whose memory was revered till far into the Middle Ages—Soranos of Ephesus, “*medicorum princeps*” and author of “many splendid works.” However firmly the great physician may have rooted himself in the soil of methodism, the liberal education which he had received, chiefly in Alexandria, doubtless contributed much to the fact that, free from petty prejudice, he did not leave untapped those sources of knowledge which his school traditionally avoided, and that, treading a different path, but bent upon the same goal, he met the best of contemporary medical investigators half-way, these being exclusively eclectic thinkers. Keen perception, clear independent judgment and a mind free from bias characterised him in an unusual degree. He was the most eminent obstetrician of antiquity, his accomplishments in gynæcology and pediatrics being fortunately known to us; the other admirable achievements and thoughts of this master, who dominated the entire range of medicine, are only to be appreciated through the more or less dim medium of translations and compilations, for, other than fragments, we possess of Soranos’ own writings only the two valuable gynæcological books almost entire.

Since it was the usual custom only to call physicians in to difficult labours, the “gynæcology” was intended chiefly for midwives. As a matter of fact, however, it far exceeded this scope and contained all the experience of the Old World in obstetrics, gynæcology and even pediatrics. Not only was the knowledge of the Alexandrians—Herophilos, Demetrios—excelled, but certain features are discernible in the works of Soranos which must have exercised a far-reaching influence upon practice. Such are his dislike of methods of superstition, in which obstetrics and pediatrics abounded (amulets, magnets etc. were employed only rarely for definitely

suggestive purposes), and his abandonment of the older, rough obstetric manipulations which were a legacy of the Cnidian school (careless use of abortives, shaking the body, jolting with a ladder, climbing stairs, etc., in order to expedite birth, various rough mechanical manipulations to promote expulsion of the placenta). In the spirit of a well-considered conservatism Soranos everywhere lays down in the most detailed manner the indications for therapeutical measures. In his teaching concerning dystocia he takes up the same attitude as his predecessors; as causes of difficult labour he includes the mother's general condition (advanced age, especially in primiparæ), abnormalities of the generative organs (*e.g.* obstruction in the vagina by tumours, narrow hips, bespeaking contraction of the pelvis), death of the child, finally abnormal positions of the same, of which he was familiar with a considerable number. The only really normal presentation, according to Soranos, is that by the head, then come foot presentations—mixed presentations are critical. Examination is carried out by means of the speculum (*δίοπτρα*).

In preparation for delivery inunctions with fat are indicated and frequent introduction of the oiled finger of the midwife into the os uteri. In normal parturition the stool of delivery is used (with a crescent-shaped aperture, and provided with back and arm supports). The midwife sits opposite whilst two women stand, one at each side, and a third behind to support the mother and prevent her from bending forwards. The perineum is supported with a linen cloth, whilst delivery is assisted by pressure upon the abdomen or by traction upon the child; separation of the placenta is brought about by the introduction of the hand into the uterus. In abnormal cases the woman is placed upon the bed of delivery; one of the most important aids, especially in deformed or fat women, is the knee-elbow position; where necessary the bladder must be emptied by catheter and rupture of the membranes performed. In order to remedy abnormal presentations, *i.e.* to convert them into normal ones, version is to be performed. Prolapsed limbs are to be replaced; a prolapsed arm, if necessary, to be disarticulated; embryotomy and evisceration, in which the *ἐμβρυοσφάκτης* (an instrument consisting of a sharp ring and a blunt hook) came into use, are only to be practised under the most compelling circumstances. It may be observed here that Soranos also undertook such operations upon the living child when the safety of the mother demanded it.

Diseases of women (amenorrhœa, metrorrhagia, hysteria, fluor albus, displacement, pneumatosis, œdema of the uterus, metritis, scirrhus, "scleroma" of the uterus, nymphomania, atresia vaginæ etc. were minutely described by Soranos and, as a rule, with the addition of a most

rational therapy (locally injections with the syringe, *μητρεγγύτης*, were used). The details concerning diet in pregnancy, care of nurslings, and early education of children constitute a collection of excellent precepts, afford a deep insight into the conditions of Roman civilisation and frequently have quite a modern ring.

The anatomy of the female generative organs, as represented by Soranos in an early chapter, is incomplete and often confused. It is noteworthy that he denies the migrations of the uterus and its animal nature, its alterations in position through contraction of the ligaments and the existence of cotyledons, whilst he is aware that the os uteri opens during coitus and menstruation. On the other hand he is unaware of the existence of the hymen, a fact which sheds a curious light upon the conditions of life in Rome. In the matter of embryology Soranos considers that the embryo is nourished only through the umbilical vessels. He denies all possibility of predicting the sex of the child by means of observation of its position. To prevent conception he recommends closure of the os uteri with cotton, salves or fat, consumption of the uterus of a mule (antipathy); abortive measures are only to be undertaken upon strong women, and upon them only during the third month; induction of abortion by puncture of the ovum he forbids on account of its danger.

In the pediatric section the following questions receive detailed treatment:—signs of maturity of the child; division of the cord (with a knife, without cauterisation, double ligature if the placenta is still *in situ*); removal of the vernix caseosa (by application of salt or carbonate of soda), washing, cleansing the eyes (with oil); removal of meconium (by insertion of the little finger in the anus; method of swathing the infant (binding the whole body in woollen bandages); nourishment (nothing for the first two days, unless it be a little cooked honey, nursing to begin on the third day, but for the first twenty days not by the mother but by a nurse, in the absence of the latter, with honey and goat's milk); choice of a wet-nurse, examination of nipples and milk of the nurse (favourable age is between twenty and forty, multipara, good milk mixes with water gradually, equally and without curdling); diet of wet-nurse (abstinence from wine, regular opening of the bowels, moderate bodily exercise), rules for putting the child to the breast (different significance of the child's cries), bathing, rubbing, anointing, carrying (in a basket on wheels), weaning (only at one and a half to two years), feeding in the first years of childhood.

Further the diseases of children and their treatment are carefully discussed (difficult dentition, where lancing the gums is forbidden, tonsillitis, thrush, ulcers, skin eruptions, catarrh, feverish affections with cerebral symptoms, diarrhoea).

As a surgeon Soranos also distinguished himself; in particular he improved the art of bandaging and materially added to existing knowledge upon fractures and injuries to the skull, of which, with refined diagnosis, he distinguished eight varieties. The original of his chief work upon internal medicine has unfortunately perished, but Caelius Aurelianus, an author and compiler of a later date, has followed him so closely that we are justified in ascribing the bulk of his work to Soranos. From the analysis of this we conclude that Soranos laid chief stress upon accurate differential diagnosis rather than upon formal definitions of disease, and assisted in no small degree in the development of the former by means of an elaborate symptomatology as well as by the employment of neglected physical methods (palpation and percussion).

Holding in general fast by the principles of methodism, he was obliged, being first and foremost a clinician, to deviate in matters of detail from the sect's barren adherence to scheme, as, for instance, when he traces the cause of a large number of diseases to the simultaneous presence of *strictum* and *laxum*; when, in inflammation of the lungs, he explains that the chief seat of the affection lies in them, in spite of the involvement of the whole body; or when he makes frequent use of venesection without restricting himself (as did Asclepiades) to pain as an indication, nor yet in the choice of locality. It was this deviation from the traditions of his school, however, which inspired the methodic sect with new vitality and ensured it a long life.

As has been shown above a fact acquires prominence in the person of Soranos which is of great interest in the history of civilisation, viz. that it was the methodic system, based upon epicureanism, which of all systems did most to combat mysticism in medicine. In a work upon ætiology he inveighs at length against the belief that nightmare (*incubus*) is due to a supernatural power (a god or half-god.) Even of the midwives he demands that they should not be superstitious, so that they may not allow a dream, mystery or customary act of devotion to interrupt any helpful treatment. Unfortunately superstition was at this time a growing force which increased till it irresistibly carried all before it.

APPENDIX

ANATOMY AND PHYSIOLOGY

THE picture generally drawn of medical methods of investigation in the early years of the Christian era requires supplementing. Medical empiricism and pathological speculation undoubtedly preponderated, but attempts were not wanting to obtain, by unbiassed and accurate observation, by dissection and vivisection of animals, an adequate knowledge of the structure and functions of the body. Alexandria in particular added to its reputation in the Roman imperial age as the nursery of anatomy, though without excelling the achievements of an Herophilos, an Erasistratos and a Eudemos. Rhuphos and Soranos owed their anatomical education to study in the erstwhile city of the Ptolemies, greater opportunities being always afforded there for the study of anatomy than in any other place.

Zootomy formed the chief means of instruction, demonstrations upon human skeletons or bone preparations being also employed, possibly also upon models and drawings, whilst much could in addition be learnt from surface observations upon the bodies of slaves; the human cadaver was only exceptionally available—at most the corpse of an executed criminal or prisoner of war.

Intimately bound up with anatomical instruction was the explanation of organic functions—physiology. It is highly probable that a few prominent investigators utilised in addition vivisection of animals in order by experiment to throw light upon vexed questions of physiology. The most brilliant among such was Marinos who, in a work consisting of twenty volumes, dealt with the entire range of anatomy and endeavoured, by experience and no doubt in part by experiment, to solve important physiological problems (*e.g.* whether blood is contained in the arteries, whether fluid penetrates into the lungs, whether the brain possesses pulsatory movement).

The table of contents is the only part of his work which has survived.

The value to be attached to this may be estimated from the fact that

Galen drew up an extract from the anatomy of Marinos (not extant) in four volumes and in particular identified himself with the former's conclusions upon the anatomy of muscles and nerves. Marinos taught Kointos (Quintus) who in his turn had as pupils Lycos of Macedonia, Numisianos (in Corinth) and Satyros (in Pergamos); Pelops of Smyrna was pupil of Numisianos. Of these anatomists Lycos and Pelops advanced the knowledge of muscles; Alianos the younger also devoted himself particularly to this subject.

Of the Alexandrians of the second century the anatomists Heracleianos and Julianos deserve special mention.

These investigators are all only known to us through references in the works of that great physician who absorbed all the knowledge and art of his contemporaries and predecessors and placed medicine upon a firm foundation—in the works of Galen.

GALEN

"The writings of Hippocrates were a model, showing how man should view the world and hand down his vision, whilst effacing himself.

Nevertheless reason could not be prevented from playing a part, for only by clear comprehension and logical presentation of the whole matter could all prejudice be set aside and all superstition be swept away."—GOETHE.

EXHAUSTED by centuries of endeavour, often moving in a circle, Greek medicine looked at last for a definitive system which should collect the scattered stones of thought and experience and incorporate them into a single edifice, thereby securing for the profession that apodictical assurance which was peculiar to the medicine of the East even in remote antiquity.

Uniformity in medical theory and stability in practice had already once been attained, by Hippocratism, which stood for the reconciliation of all previous tendencies, of frank empiricism, of natural philosophy, partly rational partly speculative, of Coan prognosis and of Cnidian topical diagnosis. The Hippocratic insight into particular cases, the individualising treatment, aided by observation of all the reactive processes of the organism, was the gift only of the few and fit among physicians who rivalled the great master in keen penetration and in a conscientious, impartial view of nature. The overwhelming majority sought a shorter way, which reduced medical art to an easily acquired technique, and whereby the therapeutics of the case in hand followed as the logical consequence from given general premises. To this end was necessary the disintegration of the Hippocratic "Physis" into its constituent elements, *i.e.* the investigation of physiological and pathological processes. Failing this, there was a relapse into empiricism.

Thus regarded, the chaotic cleavage into manifold sects and doctrines characteristic of Greek medicine after Hippocrates becomes comprehensible. The tortuous, often apparently devious paths become straight. The many divergent tendencies, united by Hippocrates in his own person,

sprang apart with the greater rebound when he was gone, each to develop independently and upon the narrowest lines.

The half speculative, half rational natural philosophy of medicine became crystallised into dogmatism, based partly upon humoral hypotheses and the system of correspondence of qualities, partly upon anatomical and physiological facts. In Alexandria dogmatism split into two sects: the followers of Herophilos, who laid chief stress upon clinical observation, and those of Erasistratos, who inclined rather to anatomical ideas and (Cnidian) topical diagnosis. Neither party fulfilled the rational ideal—logical deduction of the method of treatment from knowledge of the nature of the disease; hence arose a more enlightened form of empiricism, destined at a later date to attain to the greatest importance. True Hippocratism was a thing of the past, but anatomico-physiological knowledge, the number of disease-entities and the resources of therapeutics had grown, whilst intersectarian strife had itself led to no inconsiderable refinement of ætiology, diagnosis and medical logic.

In Rome the old sects survived, partly stagnating, partly undergoing fresh disintegration, the impulse towards radical reform of medical theory and practice imparted by Asclepiades acting herein as a ferment. The Bithynian recast the solidist pathology of Erasistratos as atomism and carried to extremes physical and dietetic methods of treatment, already practised by the gymnasts and employed with wise moderation by the Hippocratists. Nevertheless he possessed the rare art of reconciling dogmatism in theory with individualisation in practice. His followers the methodists, by adopting a middle course, which represented a compromise between rationalism and empiricism, were able to compete with the adherents of humoral dogmatism and successfully to dispute the field with the numerous sect of empirics. Their solidist doctrine, instead of losing itself in a maze of hair-splitting subtleties concerning first causes, took its stand upon the observation of general conditions in disease (*strictum*, *laxum*), and their therapeutic system, while accepting all empirical remedies, made the application of these subject to well-defined indications. Although giving their best attention to the general condition they did not in any way neglect the local. To this school belongs the credit of introducing the idea of quantity into pathology and therapeutics (raising and lowering the body forces by quantitatively graduated measures), as opposed to the dogmatic teaching upon qualities of humours and specific action of organic remedies.

Dissatisfied with contemporary development, the pneumatic school, in conjunction with the stoa, sought to assist dogmatism by galvanising

into fresh life the ancient hypothesis of "vital air," and by weaving a web of dialectics around the doctrine of the causation of disease. In practice it mattered little whether dyscrasiæ or anomalies of the pneuma were looked upon as primary causes of disease; of vital importance was the fact that, in the spirit of Hippocratism, more attention was now paid to the general state, to the phase of the disease, to individual circumstances, and that hygienic and dietetic cures were preferred to medicinal ones. Examination of the pulse as a means of accurately gauging the "tonus" of the pneuma, *i.e.* the bodily strength, was indeed carried out with an even more subtle attention to detail than formerly by Herophilos—a statement which also holds true of the theory of qualities—but it ranks, nevertheless, amongst the greatest achievements of Greek medicine.

Breaking loose from humoral dogmatism and from the first strongly inclined towards the methodists (theory of tonus, dietetic and physical therapy etc.), the pneumatic school on reaching its zenith openly unfurled the banner of eclecticism.

The leading spirits of the day were mainly absorbed in the theory of disease, but quiet progress was at the same time being made in the ancillary sciences: anatomy, physiology, pharmacy and the therapeutical branches, particularly surgery.

All these aspirations and achievements had been indicated and foreshadowed in the Hippocratic writings; from Hippocrates as a centre they radiated in every direction. One-sided expansion had developed individual ideas, often to exaggeration, the content of real knowledge had, in many domains, greatly increased, but there was wanting the integrating bond, the central point upon which the scattered rays of medical thought should once more be focussed. No sect, no school could find a path out of this labyrinth of conflicting opinions; the need was for a man, strong in action, clear of thought, a scholar to know, a critic to judge the whole range of science and art.

In the second century of our era, in Asia Minor, the cradle of Greek (and hence of European) scientific medicine, and the birthplace of its greatest ornaments, such a leading spirit arose in the person of Galen, revered as the first, after Hippocrates, of the physicians of antiquity. In him Greek medicine attained, not only its second climax, but its final conclusion in theory and knowledge; in fact, its whole antecedent development may be regarded as nothing else than a mighty intellectual process whereby, through many phases, the healing art of Hippocrates was transmitted and transformed into the healing science of Galen.

Galen was born about 130 A.D. at Pergamos, formerly the Attaline

capital, and even in Roman times famous as the nursery of art and science, as the shrine of Asclepios. He received the rudiments of his education from his father Nikon, a well-to-do architect who, himself proficient in mathematics and philosophy, mental as well as natural, early gave the receptive intellect of the boy a bias in the same direction. Nikon, as is often the case with mathematicians, combined acute logic with a curious strain of mysticism, which showed itself particularly in his belief in dreams.

Galen was devoted to his father, and never mentions him without reverence. Quite otherwise, however, does he speak of his mother. "I was blest," he says, "with a calm, just, gallant and sympathetic father, whereas my mother was of so irritable a temper that she would at times bite her maids, and was for ever screaming, and quarrelling with my father, worse than Xantippe with Socrates." Nikon, apparently believing in the saying "*Nomina sunt omina*," called the boy *Γαληνός*, calm, peaceable, but, as is too often apparent in the style of this great physician, the mother's choleric temperament was inherited by the son.

On completion of his fourteenth year Galen entered upon the study of philosophy, stoic and platonic, peripatetic and epicurean, under the various teachers of his native town. So full of interest did he find these studies that he proposed to devote himself entirely to philosophy, but a dream of his father's, supposed to be an inspiration from Asclepios, caused the now seventeen-year-old youth to change his plans and from this time forward to devote his chief attention to medicine—a resolve fraught with the most important consequences to the latter art.

Well grounded in mathematics and natural philosophy, a skilful logician and dialectician, Galen, as pupil of masters so divergent as the anatomist Satyros, the Hippocratist Stratonikos, the empiricist Aischrion, learnt now as before in philosophy to assimilate as food for independent thought the contradictory opinions of the leading philosophical thinkers without identifying himself with any individual system. The young physician seized every opportunity that presented itself in Pergamos to observe interesting cases of disease, not withholding his critical judgment even in the face of authority, whilst he also enriched his practical knowledge by study of medical folk-lore.

Galen has in his writings bequeathed so many biographical details that it is possible to draw a fairly complete picture of his course of study and subsequent experiences in practice.

Pergamos, in its Asclepieion, the resort of innumerable pilgrim patients, offered a wide field for medical observation. Thus, during an epidemic of carbuncles, Galen saw many cases (the laying bare of the deeper-lying structures by ulceration was very instructive for surgical and anatomical study), and he reports that his teacher Stratonikos was very successful in the treatment of chronic ulcers. It is characteristic of Galen that he accepts in simple faith the miraculous cures of Asclepios—obedience to whose commands he enjoined—and he later, in his reminiscences of youth, recalls several of these divine cures (notably one of

chronic pleurisy). Many other tales of wonder he relates of these times, and wrongly credits his home with the first use of snake-poison as a cure for leprosy, following the accidental discovery of its virtues.

After the death of his father Galen left Pergamos in order to seek higher professional culture and wider general knowledge by travel and by visiting the chief seats of medical learning. In Smyrna he was a pupil of Pelops, who distinguished himself particularly in the anatomy of muscles ; there, too, he widened his experience in the company of eminent physicians, *e.g.* in the subjects of nervous diseases and surgical affections, at the same time carrying on his philosophical studies.

His sojourn in Corinth was instructive to him through his intercourse with the anatomist Numisianos. Journeying through Asia Minor and Palestine he added to his knowledge in natural history and pharmacology by autopsies. It was, however, to Alexandria that he journeyed with the greatest expectations, where the best instruction was to be found upon osteology and the art of dissection, where the concourse of patients from all countries offered so large a field for clinical observation to the eager student and where, amidst the throng of physicians, every system found its representatives. Undoubtedly Galen owes much to the Alexandrian school and to his own observations ; he mentions as his teachers Heraclianos and the methodist Julianos, although he expresses himself in most unfavourable terms about the lectures of the latter. This verdict may be accounted for in no small degree by the fact that Julianos ventured to attack the Aphorisms of Hippocrates, whereby he deeply wounded the feelings of reverence which Galen had cherished for the great Coan from early youth and which intercourse with different commentators (Satyros, Pelops, Numisianos) had fostered.

After nine years' wandering we find Galen once more in Pergamos. A considerable reputation appears to have preceded him, for various anatomico-physiological treatises had already brought the young physician into notice, and he had, on many occasions, displayed his dexterity ; his friendly relations with the priesthood also now stood him in good stead. Thus on completion of his twenty-eighth year he was appointed by the high priest in charge of the summer festival games as physician to the gladiators, a position he held with credit for four years.

Before 151 A.D. Galen had written an anatomy of the uterus for the use of midwives, a diagnosis of diseases of the eye, three books upon the movement of the lungs and the writing upon medical experience (polemic between Pelops and the empiric Philippos). Even in his ripe manhood he attached great value to the experience gained in his youth upon himself and others. He suffered repeatedly in the autumn through excessive consumption of fruit ; in his twenty-eighth year he was, from the same cause, in considerable apprehension

of the formation of an abscess, so that he decided to cease eating fruit altogether. His cure upon this occasion he ascribes solely to the favour of Asclepios, whose servant he thenceforth subscribed himself. On several occasions he suffered from different fevers, but this state of things was promptly remedied when he adopted a rational mode of life upon his own dietetic system. In Alexandria he acquired a rich experience upon the influence of articles of diet and climate, and also cured his fellow-student who was seized with illness in consequence of eating unripe dates. In Pergamos he cured several patients by methods of his own, a throat affection by a remedy obtained from green nut-shells, a pain in the liver by venesection between the thumb and the index finger: he also collected material towards elucidation of the doctrine of critical days.

As physician to the gladiators he had mostly to do with surgery, wherein he devised ostensibly new methods (*e.g.* in cases of severe injury soaking the bandages with red wine to allay inflammation; a method of treatment for injuries to tendons), but he was keenly observant of cases likely to add to his anatomical and physiological knowledge, and he made careful use of observations upon athletes concerning dietetics and gymnastic exercises.

Conscious of his wide knowledge, burning with ambition, and yearning for a larger scope for his activities, Galen once more left his native city, where an insurrection had lately broken out, and went to Rome to seek his fortune. He rightly looked forward to a considerable expansion of his professional experience through his change of residence to Rome and made, in this respect, a comparison between the giant city and the small towns in which Hippocrates worked. Assisted on his arrival by some compatriots he quickly succeeded, not only in making good his footing, but by surprising diagnoses and unexpected successes, often in direct opposition to established practice, in attracting attention and making a name. Like Asclepiades before him Galen soon found favour with the gifted and the great, and his fame grew when, before the élite of Roman society, he began to hold discourses in attractive form upon the structure and functions of the human body. He counted amongst his friends the philosophers Eudemos and Alexander of Damascus and amongst his admirers the consul Boethus, the future prefect Sergius, M. Cívica Barbarus, the uncle of the emperor Lucius Verus, and the son-in-law of Marcus Aurelius, Cn. Claudius Severus—all men of great position and influence. Galen, however, neither absorbed in his often lucrative practice, nor carried away by dilettante rhetoric, laboured steadfastly and ceaselessly in the cause of science, and during this epoch some of his most important and comprehensive works upon anatomy and physiology were produced. Galen's great success in Rome as a practitioner, investigator and teacher soon found, however, its counterpoise in many reverses and disconcerting experiences.

The moral standard of members of the medical profession in Rome was, to judge from contemporary writings, a very low one, thrown as they were pell mell together, unequal in culture and divided into sects.

In the spirit of the times they waged war on each other, partly with unbridled language, partly with the poisoned weapons of intrigue. Mercilessly each would expose the weakness of the other before the public, intent only upon personal notoriety, regardless of the means by which it was attained. It is easy to imagine the envious glances cast at the growing reputation of the newcomer who, by his great achievements, had eclipsed his rivals. It was not long before envy changed into disfavour, into open hatred, for Galen, undeniably filled with vanity and self-conceit, loudly vaunted his superiority in speech and writing, in his demonstrations and at the bed-side. With scathing mockery he held up the weaknesses of his antagonists to public derision, ridiculed the reigning schools (Erasistratean and methodic), whilst he himself, by methods little short of unscrupulous, wooed the favour of the public and constituted it his judge.

Quoting apparently from note-book entries Galen in after times described with proximity and self-complacency his therapeutical and diagnostic successes during these early years in Rome. These descriptions clearly show that he knew, where science failed, how to make the best use of accidental circumstances, how, with deep insight into human nature, to obtain by suggestion the result that medicine was unable to effect. "Often" says he to his pupils "chance is the hand guiding us to fame, but there are few able to grasp it." No experienced practitioner who knows how often accidental circumstances lead to a diagnosis, how helpful to the patient a veiled suggestion may prove, will be over-hasty in condemning Galen's procedure as charlatanism. What offends our modern sense of fitness is the emphasis that the great physician lays upon this aspect of his art, the pomposity with which he parades it, and the scorn which he pours upon his less gifted and less fortunate colleagues, often in most uncalled-for manner. From the continual outbursts of self-applause which they contain, Galen's treatises would appear to have been written only "pro domo." In this connection, however, it must be borne in mind that the sharp utterances of Galen were at least more or less well-founded, and that in judging them allowance must be made for the spirit of the age, whilst in fact no contemporary physician approached him in medical knowledge and many-sided culture. The first clinical history may be taken as typical. It deals with Galen's renowned countryman the peripatetic Eudemos, in whose case Galen predicted the cessation of a quartan fever accurately to the day; on this occasion the Roman physicians are accused, not only of envy, but also of greed, rascality and spite. In the description of another case where a relapsing melancholia was cured, the most eminent of his fellow-physicians were abused as foolish, ignorant and impudent. An example of his intelligent use of fortuitous circumstances in the establishment of a diagnosis occurs in the examination of a Sicilian physician, suffering from a disease of the liver, when Galen took note of everything in the sick-room that could serve as an indication of the nature of the disease, while ostensibly deriving his information from the state of the pulse. The same *savoir-faire* enabled him to effect a "miraculous" cure in the cases of one of the sons and the wife of Boethus—which brought him no less than 400 gold pieces (£417), and with great self-satisfaction he relates several instances wherein he acutely guessed the psychical cause of apparently severe ailments. A case which added much to his renown in this respect was that of a great Roman lady, wife of Justus, whose insomnia he was able to trace to an unhappy affection for the dancer Pylades.

Under such circumstances his relations with his colleagues soon became strained, the fault doubtless resting with both parties. In his isolation Galen characteristically

turned to the laity who, he said, "at least had common sense, which was wanting in the sophist physicians, who had only hatred for the brilliant successes they failed to understand."

One can readily understand the professional jealousy aroused by his success, as people of rank and culture literally crowded to attend his public demonstrations upon physiology, at which goats and pigs were subjected to vivisection. Even in his first year in Rome Galen resolved to speak no more than was absolutely necessary upon his professional visits and to appear no more in public; disgusted with life and work in the capital he even wished himself back in the provinces.

Of Galen's character, however, it must be said that his faults, which were in part a reflection of the pretentious age in which he lived, were expiated by the fact that the busy practitioner, in the midst of the distractions surrounding him, possessed the energy to produce works which ensure his lasting fame.

Thus he wrote at this time the first six books of the "Doctrines of Hippocrates and Plato," the first book of "The Functions of the Parts of the Body" the treatise upon bones, veins and arteries, and nerves. Many other results of the literary activity of this epoch of his life have been lost, two books upon the causes of respiration, four books upon the voice, six books upon the anatomy of Hippocrates, three books upon the anatomy of Erasistratos, two books upon vivisection, a book upon zootomy and a treatise upon the harmfulness of venesection.

According to his own account fearing the worst from the intrigues of his enemies—who were supposed to be planning the assassination of their successful rival—Galen in the year 166 A.D. left the capital, which he had entered with such high hopes, after a four years' stay, in secret, without farewell, a fugitive.

It is at least noteworthy that this hasty departure coincided with the moment when, through the intervention of powerful patrons, his long-wished-for entry to the imperial court was assured—and under such protection there was no longer anything to fear. It is even more remarkable that Galen left Rome just as that epidemic approached with giant strides, which was to overrun the empire like a deluge of destruction and shake it to its foundations—the plague. The great physician cannot escape the reproach that, under such circumstances, he should have deserted his post, whatever dangers, real or imaginary, might threaten.

The "plague," so called by Antonine or Galen, was first introduced from Syria by the Roman army, and gradually spread over the whole of Europe. It broke out in Rome in the year 166 A.D. The extraordinary contagiousness of the epidemic is emphasised in all contemporary reports. There appear to have been a variety of simultaneous manifestations, the descriptions indicating chiefly affections resembling small-pox or dysentery, but adequate criteria upon which to express an opinion are wanting. The "plague" commenced 165 A.D., claimed innumerable victims and lasted at least fifteen years. Galen mentions the epidemic in several of his writings.

Galen's homeward journey was slow, as he made pauses of shorter or longer duration in various places for the purposes of study. Thus in Campania he came to know Tabiæ, celebrated for its air and milk cures, in Cyprus he visited the copper mines and took from them quantities of

medicinal ores. In Palestine he collected Balm of Gilead, at the Dead Sea asphalt, and in Phœnicia native and Indian drugs. Only a short stay was granted him in Pergamos, for, in the meantime, the two emperors Lucius Verus and Marcus Aurelius Antoninus, whose attention had been called to the great physician, summoned him by letter to Aquileia, where they were at that time preparing for the war against the Marcomanni. Galen apparently obeyed this behest only after some hesitation; journeying by Lemnos through Thrace and Macedonia he arrived in Aquileia in the winter of 168-9 A.D. The renewed outbreak of plague, which was decimating the army, compelled the emperors to flee to Rome with a small following, Verus succumbing to the disease on the way. Marcus Aurelius invited Galen, who had followed the emperor to Rome, to accompany him on his campaign against the Marcomanni, but (warned, as he said, in a dream by Asclepius) Galen contrived that the noble ruler should excuse his attendance and entrust him instead with the medical care of the young Commodus at Rome. His court duties making but little demand upon his time, Galen was enabled to devote his undisturbed attention to scientific work and the period 169-180 A.D. (the year of Marcus Aurelius' death) includes his most voluminous and epoch-making works.

After the death of the court physician Demetrius, which occurred during the war on the Marcomanni, Marcus Aurelius, then on the Danube, appointed Galen as his successor; his chief duty was the preparation of the favourite treacle mixture of the emperor who was in the habit of partaking of it daily as a prophylactic measure, the constitution of it varying with his state of health. The numerous ingredients of this panacea had to be of the finest quality and were requisitioned from many lands.

Soon after the return of the emperor (end of 176 A.D.) Galen effected a cure upon Marcus Aurelius on which he prided himself not a little. He himself describes it as "really marvellous," and relates the episode in his usual boastful, declamatory style. The emperor had suffered for several days from an acute illness, accompanied by fever and painful evacuations, which the court physicians held to be a feverish paroxysm and which they had treated with purgatives. "Hereupon" relates Galen "I was summoned also to spend the night in the palace, a messenger coming to fetch me, by order of the emperor, just as the lamps were being lighted. Three physicians had seen him in the morning and at the eighth hour, and two had felt his pulse, whilst to all did it appear the beginning of an attack. I, however, remained silent; then the emperor, perceiving me, asked why I had not, like the others, felt his pulse. I replied: 'Two have already done this, and from their experience upon the journey with thee are better able to judge of its present condition.' As I said this he called on me to feel him, and as the pulse, taking into consideration the age and constitution of the patient, seemed to me inconsistent with an attack of fever, I declared that none was to be feared, but that the stomach was overloaded with nourishment which had been coated with phlegm. This diagnosis called forth his praise and he thrice repeated: 'Yes, that is it, it is exactly as thou sayest; I feel that cold food is disagreeing with me.' He then asked me what was to be done. I answered him frankly that if another than he had been the patient I should, following my custom, have given him wine with pepper. 'With sovereigns like thyself, however, physicians are in the habit of employ-

ing the least drastic remedies, therefore it must suffice to apply wool saturated with warm spikenard upon the abdomen.' The emperor replied that warm ointment on purple wool was his usual remedy for pain in the stomach, and called Peitholaos to apply it and let me go. This being done and his feet warmed by rubbing with heated hands, he demanded Sabine wine, threw pepper into it and drank, after which he said to Peitholaos that now at last he had a physician and a courageous one, repeating that I was the first of physicians and the only philosopher; he had tried many, not only the covetous but those greedy of fame and honour and those filled with envy and malice. As I have just stated this is the most remarkable diagnosis I have made." . . .

Under subsequent rulers the connection of Galen with the court seems to have been less close although, in a writing of the time of Septimus Severus, he boasts that he has stood high in the esteem of each successive emperor. Entirely devoted to science, with literary activity unflagging to the last, labouring for posterity, though honoured by his contemporaries, Galen died in 201 A.D. Where he spent his last years, whether in Rome or in Pergamos, is unknown. The writings of Galen are beyond comparison comprehensive and many-sided; they deal, not exclusively with medicine, but also with philosophy, philology and rhetoric. His works are unequal in finish, only a portion had received the final polish, whilst others exist merely in outline; some are voluminous, others but fragmentary treatises; as regards their contents they are in part commentaries and compilations, in part controversies and didactic works; the style is mostly declamatory, verbose and occasionally involved. Interpolations having crept in even in his lifetime Galen brought out a compendium of his works and an introduction to their study—both are in existence and afford us the most important clues, although he wrote several works subsequently. The chronological sequence has been approximately determined, this much at least being clear—that Galen in his medical writings began with anatomico-physiological themes and later, as his experience widened, passed on to pathology and therapeutics. Of the non-medical works only scanty fragments have been preserved, and of the medical a considerable number were lost (notably in a conflagration which, shortly before the death of Commodus, laid the Temple of Peace in ashes and also destroyed the ἀποθήκη where Galen had stored his manuscripts). Much remains still unedited (particularly in Arabic and Hebrew translations) in dusty libraries, whilst on the other hand many treatises bearing the name of Galen are spurious or at least doubtful.

The education and surroundings of great personalities afford no complete insight into their natures; in psychological analysis there is always a residuum, an unknown quantity, in which are inherent the idiosyncrasy, the suggestive influence and the intellectual power. Nevertheless the history of his career and of his times throws a searchlight upon the actions

of an outstanding personality ; it affords some explanation of his disposition, brings his greatness and success into true perspective. This holds specially true of Galen. It might even be said that the whole development of medicine, which was repeated ontogenetically in his own studies and without which his greatness had been impossible, forms a pedestal for the great physician of Pergamos. Syncretism in medicine, in association with renewed attention to the exact ancillary sciences (*e.g.* anatomy) and methods of investigation (*e.g.* study of the pulse), indicated the lines along which reform must move. Philosophic eclecticism, with its tendency towards reconciliation of Platonists with peripatetics, united to his strong aversion from scepticism and bias towards teleology and monotheism, imparts a characteristic colouring to Galen's mode of thought ; the prevailing confusion, the longing to see an end put to the intersectorian strife, the small capacity of his contemporaries for any strenuous endeavour, all these paved his way to success. The ground was thus ready for the fruitful seed which Galen's commanding talent, immense power of combination and matchless industry scattered with a lavish hand.

Time had laid the foundation upon which the gifted son of Nikon, proving himself a master-builder in the realm of thought, was enabled to erect the edifice of his own all-embracing system of medicine out of the ruin of those that had gone before—a symbol in one sphere of the overwhelming influence of Greek intellect and Roman energy upon the world, and a structure which should suffice for the medicine of many centuries and of many lands.

The end at which Galen aimed in his every effort, successful or otherwise, was the conversion of medicine into an exact science. Attempts at this had not indeed been lacking before his time, but no one had based his endeavour on so wide a groundwork.

Although his initiation into medicine took place principally through the empirics, his logical mind early came into conflict with the principles of this school, which from the first lacked rational foundation. Still less could he find satisfaction in methodism, which arbitrarily restricted the field of medical investigation, and the adherents of which were for the most part entirely lacking in any philosophic culture. He had, therefore, to seek the shelter of rationalism, whereby the necessary conditions of a truly scientific method were apparently fulfilled. These, in his eyes, were that, like a geometrical proof, deductions should be drawn in strictly logical form from established premises. Applied to medicine this means the deduction of therapeutics from knowledge of disease and from insight into the action of remedies.

Galen gave much attention to methodology, and treated this most fully in the writing *περὶ ἀποδείξεως*, which has unfortunately perished. He declared Euclid's method of proof to be the best, for which reason he demanded of physicians and philosophers some previous acquaintance with mathematics; as appears above, he himself, thanks to his father's teaching, possessed such a training in no small degree. He wished to found an universal scientific method, analogous with the system of geometry, which should deduce its principles and formulate its conclusions from perception of the senses and direct evidence of reason. *πείρα* and *λόγος* are the foundations, these he calls *δύο ἀπάσης εὐρέσεως ὄργανα*. This would seem in accordance with Hippocrates' precept, with this great difference, that the Coan physician admits only those conclusions based on wide experience (inductive) rejecting such as are arrived at, not through actual perception of the senses, but through reflection upon a merely plausible assumption. Galen, on the other hand, recognises, in addition to sense perceptions, a direct assurance of reason, to which category belong the axioms of common sense and convictions formed by scientific inquiry. Trial and experiment undoubtedly constitute a criterion, but the *λόγος* and therewith the deductive method is assigned a higher position than true Hippocratism would have accorded them. Galen entirely fails to recognise the immense difference existing between mathematical and empirical sciences, assuming axioms in the latter *a priori*, whence he arrived at the egregiously false conclusions to which the "geometrical" method in medicine was bound to lead him. In certain restricted branches, however, where anatomy afforded a firm basis, or where physical laws formed a starting-point, deduction led to success. According to Galen scientific medicine takes its start from phenomena perceptible by the senses, or symptoms. The symptoms are not to be observed haphazard, but only those which indicate the cause and seat of disease and the general condition; from knowledge of the cause of disease follows the choice of treatment; from knowledge of the seat of disease follows the method of its application; from consideration of the general bodily condition follows the measure of the required treatment. Further the *ιστορία*, i.e. earlier and vicarious experience, must be considered, to be turned to account in forming conclusions by analogy upon therapeutical matters. Here also the essential is to be distinguished from the non-essential, for similar methods of cure are only indicated when the chief symptoms are identical. It is plain that Galen adapts the empiric "tripod" to be the dogmatic standpoint (cf. the chapter on the empirics). The scientific method further lays great stress upon the indications, but not in the same sense as did the methodists who deduced them only from the degree of *strictum* and *laxum*. Multiplicity of diseases bespeaks multiplicity of remedies; their application has to be in conformity with the principle *contraria contrariis*. This strictly logical method does indeed constitute the ideal for medicine of all times, but it is an ideal the realisation of which is still far distant. Galen and all subsequent system-builders, up till recent times, failed to recognise that a strictly causal therapeutic system corresponding with the status of the auxiliary sciences, could only have a very limited scope, and that medicine, so long as exact science is incomplete, must be content with the provisional, critical empiricism recommended by Hippocrates.

Galen indeed accepted dogmatic principles, but maintained his independence as critic and investigator, giving on the one hand an incomparably broader basis to rational medicine by development of the accessory sciences, whilst on the other not neglecting the achievements and opinions of other schools. Hence, in his system, the most heterogeneous elements can be traced.

As has often happened in the history of our science the reformer of

Pergamos identified himself with Hippocrates, or rather with the Corpus Hippocraticum. This collection of writings served him as text for spirited commentaries wherein he showed a strong bias towards theory. Although Galen paid the highest honour to Hippocrates, denouncing his opponents as ignorant men and mere hair-splitting dialecticians devoid of common sense, although he earnestly sought to emulate the great physician in practice and particularly in prognosis, yet his very attitude towards Hippocratism distinctly shows that straightforward, unsophisticated observation had given place to artificial, pedantically subtle erudition and that the power of observation of the over-refined age of the Cæsars was not that of the era of Pericles. Knowledge and art had grown materially, but wisdom and independent and unfettered thought had suffered a decline.

The Galenical system is grounded on speculation in natural philosophy, anatomical research, physiological experiment and clinical observation, but it is to be remembered that these methods were employed in very unequal measure.

In sharp contrast with atomism Galen assigns equal importance to forces and to elements and qualities ; he takes as the axiomatic presumption of his vital theory design in all natural processes, the proof of this in individual cases being the chief purpose of research. The bearer of life and of the vital forces which govern matter is the pneuma. Corresponding with the three primary forms of life, the psychical, animal and vegetable and the three primary forces, *δύναμις ψυχική*, *δ. ζωτική*, and *δ. φυσική*, the pneuma manifests itself in threefold form, viz. as psychic, animal and natural. The *πνεῦμα ψυχικόν* has its seat in the brain and is distributed by way of the nervous system ; the *πνεῦμα ζωτικόν* is transmitted through the heart and arteries, it manifests itself in the pulse, whence the vital force proper to it (*δύναμις ζωτική*) is also called *δύναμις σφυγμική* ; the organs of the *πνεῦμα φυσικόν* are the liver and veins. The fact that these three manifestations of life can again be separated into different functions is accounted for by the existence of lesser forces subordinated to the primitive ones, each with a strictly defined sphere of influence. Thus digestion, nourishment, growth of individual organs, secretion are the work of these subordinate forces, amongst which may be distinguished the attracting (*δύναμις ἐλκτική*), the fixing (*δ. καθεστική*), the transforming (*δ. ἀλλοιωτική*), the expelling (*δ. πρωστική*), the excreting (*δ. ἀποκριτική*). Each organ possesses its own individual existence and its special and peculiar force, which brings about its specific effects ; it pervades the entire substance and is not susceptible of further elucidation. Persistence of

vital phenomena and function of vital forces are conditional upon constant renewal of the *pneuma*. This renewal takes place by absorption of *pneuma* from air by way of the lungs, as well as by the pores of the skin and by arteries, *i.e.* by respiration. This dynamic conception, based partly upon Platonic and Aristotelian, partly upon stoic principles, is reinforced by material analysis, founded upon conceptions derived from natural philosophy on the one hand and anatomy on the other.

In the Galenical, as in other systems of antiquity, the idea of the correspondence of macro- with microcosm was followed out. The four elements, fire, water, air and earth, and the four primary qualities, the warm, cold, moist and dry, correspond with the four cardinal fluids, blood, phlegm, yellow and black bile. Blood is produced by the primary qualities and contains the elements in equal proportion, in the other three humours one element preponderates; in phlegm, water; in yellow bile, fire; in black bile, earth. The so-called secondary qualities, perceptible by the senses, are the results of variable admixture of elements (*i.e.* primary qualities): such are varying taste, smell, hardness or softness, wet and cold, warmth and dryness. Mixture is movement, and the final condition of equilibrium is called temperament. From the anatomical point of view the body may be divided according to its structure into like and unlike parts (*ὁμοιομερῇ καὶ ἀνομοιομερῇ*), to the former belong ligaments, tendons, bones, nerves and blood-vessels; to the latter, organs. Each structure has its temperament; the red, warm, soft and moist portions originate in the blood; the white, cold, solid and dry, on the other hand, from the seed.

Galen gives no decided answer to the question whether the vital forces, which are carried by the *pneuma* and bound up with the elements, are primary or merely the result of intermixture. The problem of the soul, too, he holds insoluble, but on account of the great dependence of psychical on physical conditions, he is more inclined to the view that mingling of the elements determines the functions of the soul. Dependent on this is the threefold division of the soul, the seat of reason being in the brain (*ψυχῇ λογιστικῇ*), of emotion in the heart (*ψ. θυμοειδής*), of desire in the liver (*ψ. ἐπιθυμητικῇ*).

The application of these general ideas to the theory of health and disease called by way of complement for direct investigation into the structure and functions of the human body.

Galen, scholar of Alexandria, treading in the footsteps of masters of the art of dissection, of whom Marinos was pre-eminent, made a lifelong study of anatomy, collated and corrected already existing knowledge and discovered no little that was new. His anatomy was for centuries the standard, but was, unfortunately, in many ways inaccurate, and this in addition to technical imperfections and inexactitudes, mainly for two

reasons. In the first place it was based upon dissection of animals only, the results being by analogy applied to man; in the second place his investigations were not conducted impartially; instead of constituting the starting-point for physiology his anatomy had to accommodate itself more or less to physiological speculation. Hence Galenical anatomy, in addition to many excellent descriptions, *e.g.* of bones and their articulations, ligaments, numerous muscles (muscles of mastication, of the spine, *platysma myoides*, *interossei*, *popliteus*, origin of *tendo Achillis*), of the heart and vessels, nervous system, (portions of the brain, central nerves, course of the facial nerves, connection of the same with the trigeminal, vagus, recurrent branches), contains many mistakes, *e.g.* *os incisivum*, *rete mirabile*, pores in the inter-ventricular and inter-auricular heart walls, four lobes to the liver, double bile duct, two-horned uterus and so on.

Opportunities for the investigation of the human body very rarely fell to the lot of the investigator. Galen himself only twice obtained, through accident, possession of a human skeleton, once in the case of a corpse washed out of its grave by a river in flood, the second body being that of an executed robber. Permission to dissect the bodies of enemies killed in battle was of very little value to science since the technically ill-equipped surgeons attached to the Roman army were not in a position to derive much advantage therefrom. Galen dissected chiefly the anthropoid apes and, in addition, bears, swine, solidungulates, ruminants, once an elephant, as well as birds, fishes and snakes. He utilised his discoveries upon the anthropoid animals unscrupulously for human anatomy; in his description of the human intestinal canal he allowed himself to effect a compromise between its nature in carnivores and herbivores; the spinal cord he described as continued to the end of the spinal canal. Galen enjoined diligent systematic study of anatomy, "which is not to be learnt from books or fugitive inspection"; he declared anatomical knowledge to be an important foundation for medicine and particularly for surgery, but held that the most important thing was not mechanical preparation *per se* but topographical and physiological observation. He was never content to abide by plain facts, but had a predilection for speculation, institution of comparisons and drawing of analogies in anatomy, through which, however, he occasionally had striking ideas, *e.g.* correspondence of the male and female generative organs.

As an issue from the Platonic and Aristotelian cosmology, with its strongly marked teleology, Galenical physiology was in its essence nothing but a skilful and well-instructed special pleading for the cause of design in nature. The body is created according to the reasoned plan of a Supreme Being, the structure of organs is arranged for the fulfilment of pre-existing ends.

Through the wealth of his observations, the acuteness of his perceptions and even the technique of his investigations Galen achieved excellent results in individual branches of physiology, he may indeed lay claim to have been the founder of experimental physiology. As, however, he seldom approached facts without bias and usually joined *a priori* speculations to exact results, he, for the most part, deprived his best conclusions of their value and missed the mark in fundamental questions.

The title of his chief anatomico-physiological work—*De usu partium*—denotes the spirit of his inquiry. The cardinal fault lay in the fact that Galen sought to explain nature's execution before her mechanism had been demonstrated; whereby, in the majority of cases and when he came to details, he lost himself in arbitrary assumptions. Anaxagoras had already quoted adaptation to function as an argument against teleology; later the philosophers and physicians, particularly of atomistic tendencies, combated the existence of design in the structure and functions of the human body. The authority of Aristotle, however, proved the stronger, and the influence of the stoa brought teleology, albeit in a simple and popular form, into recognition. Galen repeated the contentions of Aristotle and adduced as proof of purposeful design, amongst other arguments, the striking uniformity of structure of the body combined with variety of function. In his teleological reflections, which sometimes border on the comic in their attempts to demonstrate the merits of the human frame by the results of investigations carried out upon animals, Galen is here and there overcome with ecstatic admiration of the goodness and wisdom of providence. "True piety," he says, "consists, not in the sacrifice of hecatombs, not in the burning of incense, but in the appreciation and proclamation of the wisdom and omnipotence, the infinite love and goodness of the Father of all things. His goodness is shown in His wise care for all His creatures each of whom He has provided with his requirements. Let us praise the goodness of the Creator in hymns."

Elsewhere Galen opposes those who like Moses hold the power of the supreme being to be unlimited, and he rejects the Mosaic cosmogony, since this sees, in the absolute will of God, the sole foundation of existence and of the harmony of creation, irrespective of inviolable law. From the teleological point of view Galen's chief endeavour is to elucidate first causes and therewith the purpose underlying resultant effects. "For," said he, "it were laughable if any one to the question why he went to the market, were to say 'Because I have feet that move,' instead of saying, 'because I wish to buy something.' In the first answer there is indeed a cause, but not the primary and real one."

He recognised four kinds of causes: the first is the final cause, why a thing happens; the second the instrumental, by whom it is done; the third the material, from what it originates; the fourth, the auxiliary, by what means. Galen, in his preference for *causæ finales* as against *causæ efficientes*, is but a disciple of Aristotle, as in the conception of *entelechy*, actuality and potentiality.

The three main organs are the liver, the heart and the brain. In the liver the blood is formed from nutriment. In digestion three processes are distinguished; the first occurs in the stomach, the second in the liver, the third in the organs. Each of these furnishes waste products which leave the body. The food taken is digested in the stomach, digestion being assisted by warmth transmitted from the four lobes of the liver, and it enables the functions of the four subordinate organic forces (attractive, fixative, alterative and excretive) to be carried on. Chyle, originating in the small intestine, is conveyed by way of the portal circulation to the liver where the *πνεῦμα φυσικὸν* (*spiritus naturalis*) converts it into blood (second digestion). Previously, however, the spleen—which, according to Galen, is only from lack of room not in close relationship with the liver—has exercised its activity as a purifying organ, extracting from the nutriment the thick, earthy portions which go to form black bile. The latter

passes by a duct in the first place to the stomach, thence into the intestine, and is evacuated with the fæces. One portion of the blood flows from the liver through special veins directly to the rest of the body, but another portion through the venæ hepaticæ and ascending vena cava to the right heart. There, by means of the "inherent" warmth, a further process of purification takes place, the useless residuum escaping as soot or smoke (*λινγύς*) during expiration through the open semi-lunar valves. From the right heart the blood penetrates on the one hand into the pulmonary artery and lungs, on the other through the hypothetical pores in the septum into the left heart, where it again undergoes a process of perfection. This is brought about by the *pneuma* which, entering the system with air in respiration and reaching the left heart in diastole through the pulmonary veins, mixes with the blood (as *πνεῦμα ζωτικόν*) and imparts to it a cleaner, thinner, vaporous consistency. The mixture, consisting mainly of the *πνεῦμα ζωτικόν* (*spiritus vitalis*), and to a less extent of blood, circulates through the body by means of the arteries.

The heart is the fountain-head of the inherent warmth, the place of preparation of the *πνεῦμα ζωτικόν*, and distributing organ of the blood and vital spirit. Right and left ventricles move simultaneously; only the diastolic phase is active. The right ventricle warms the blood in it and dispatches it by the systole into the veins; the pulmonary artery (*φλέψ ἀρτηριώδης*) supplies the lungs with blood for the purpose of nourishment only. The left ventricle draws blood during diastole from lungs and pulmonary veins, prepares the *spiritus vitalis*, vitalises with it the blood mixture received from the right heart and drives the vaporous compound, mostly consisting of *pneuma*, into the arterial system by means of its systole. The left heart wall is considerably thicker than the right, so that it may not, in spite of its airy contents, be lacking in weight, and thus the heart, maintaining its balance, shall remain in a vertical position. Anastomoses exist between arteries and veins, particularly between their terminations, analogous with the pores in the cardiac septum, whereby a portion of the arterial *pneuma* penetrates into the blood-containing veins. The total mass of blood was thought by Galen to be very small, particularly in old age, and, whilst he seems to have assumed a rhythmic to and fro movement of the contents of arteries and veins, a knowledge of the circulation, frequently imputed to him, is nowhere indicated. Since he considered the chief function of the heart to be preparation of the vital spirit—the execution of which task is intimately connected with respiration—he had to assume that the activity of the heart only began after birth. In the Galenical physiology of the vascular system the baleful influence

of scientific suppositions and premature speculations is clearly seen. Galen had not neglected to attempt a solution of the problem by means of observation (upon a boy whose sternum had been destroyed by caries) and numerous experiments on animals, watching the movement of the heart (even after division of the great vessels), examining the contents of the ventricle etc. He did, indeed, describe with fair accuracy the heart movements, he established, in opposition to the Erasistrateans, the fact that the left heart also contains blood, but the fundamental truths escaped him entirely owing to his prepossession by the pneumatic theory and by the doctrine of the formation of blood in the liver. That the value of experiment lies in its unbiassed interpretation is best proved by the fact that Galen, through a supposedly accurate research upon animals, gave the doctrine of the arterial pulse an impetus in an entirely wrong direction. The rhythmical activity of the heart he traced, upon general dynamic principles, to the *δύναμις σφυγμική*; the question then arising as to the origin of arterial pulsation, whether independent of, or contingent upon the power of the heart. Earlier authorities had explained one or both phases of pulsatile movement as an active process, or else they considered the pulse as a passive phenomenon due to pressure of *pneuma*. To decide the question Galen undertook the following crucial experiment. Having exposed the femoral artery he ligatured it in two places, causing the pulsation to cease. He then opened the vessel between the ligatures and inserted a metal tube; relaxation of the ligatures caused the pulse to reappear. As a control he repeated the entire experiment, but with this difference, that he previously applied a third ligature nearer the heart. In this case, after removal of the two lower ligatures, the pulse remained absent, from which he concluded that "the pulsatile force was prevented from reaching the arteries from the heart," therefore that arterial pulsation was the result of power transmitted from the heart. Galen's researches in other directions were more fruitful, notably in dealing with the problem of the mechanism of respiration. Experiments, which consisted in cutting the intercostal muscles or their nerves, excision of a rib, transverse section of the spinal cord (paralysis of the phrenics), amplified by observations upon penetrating wounds of the chest, led him to these conclusions among others: that quiet respiration is performed mainly by the diaphragm, but forced breathing by the intercostals as well, and that in inspiration the air enters mechanically into the expanded chest cavity. Upon this question Galen allowed himself to be led, through misinterpreted experiments and observations, to assume that the pleural cavities (which he blew up with a tube) were normally filled with air, whereby expansion and contraction were facilitated.

Respiration in the Galenical sense is participated in by the heart and entire arterial system as well as by the lungs, the arteries receiving air through the skin in diastole, and excreting "soot" through the same in systole (perspiration). Pulse and respiration, therefore, serve an identical purpose. According to Galen combustion and respiration depend upon the same ingredient of air which, he hopes, will in the future be discovered.

Remarkable results were achieved by Galen in the physiology of nerves, brain and spinal cord—work which was truly epoch-making. Division of nerves or of the spinal cord at different levels furnished definite results upon questions concerning the cause and seat of various paralyses, and even removal of the brain (in pigs) by slicing, which Galen undertook in order to determine the functions of the cerebrum, was a highly meritorious experiment, although it did not fulfil its purpose.

The brain is the seat of thought (*ψυχῇ λογιστική*), the centre of sensation and movement, and these functions depend upon the *πνεῦμα ψυχικόν* which is prepared from the choicest contents of the carotids in the choroid plexus of the lateral ventricles.

In support of the pneumatic theory Galen expends much speculative ingenuity upon elucidating anatomically the paths traversed by the "soul-spirit," and it was even more harmful for the future that he should have adhered to the old doctrine of secretion, according to which the impurities (viscous moistures) of the brain are discharged through the ethmoid into the nose and mouth (the finer particles through the cranial sutures). In keeping with this view he placed the sense of smell in the anterior ventricles of the brain (instancing headache, which can be induced by strong olfactory stimulation).

The following points from the Galenical physiology of brain and spinal cord may be mentioned. The brain itself is insensitive; it possesses a movement synchronous with respiration, which serves to drive the *pneuma* out of the ventricles into the nerves; the meninges are a support and covering and unite the blood-vessels; pressure upon the brain induces stupor; injury to the fourth ventricle or upper portion of the spinal cord is fatal. The seat of the soul is in the cerebrum, not in the meninges. The spinal cord conducts sensation and movement, it may be looked upon as the brain of the parts below the head, and sends out nerves as it were in streams. Longitudinal section of the spinal cord causes no paralysis, cross-section induces bi-lateral paralysis; if it be cut across between the third and fourth cervical vertebræ cessation of respiration ensues, if between cervical and dorsal vertebræ the animal only breathes with the diaphragm and upper trunk muscles. Section of the recurrent nerves is followed by aphonia, of the fifth cervical nerve by paralysis of the scapular muscles. Galen regarded ganglia as organs for reinforcement of nerves. The sympathetic, formed by the fusion of cranial and spinal nerves, is the cause of the great sensitiveness of the abdominal organs. Nerve-power is like sunshine, which penetrates air and water.

In the physiology of the senses *pneuma* plays the chief part. With a happy inspiration, in explanation of hearing, he likens the propagation of sound to a wave.

Regarding embryology Galen undoubtedly dissected animal embryos (description of the

membranes, and course of vessels), as he made no observations upon early stages of development and did not study that of the chick in the egg, to say nothing of the human embryo, his views contain a mixture of truth and invention. Galen considers that the embryo originates from a combination of the warmer male with the colder female seed; the former transmits individual characteristics, the latter those of the species. The old error that males originate upon the right and females on the left side is perpetuated. Menstrual blood furnishes nourishment for the growing embryo. All organs can be divided into two groups, those that spring directly out of the seminal fluid and those that arise from the blood supplying the uterus: such parts as are of a fleshy nature (*e.g.* liver and other viscera) arise from blood, such as are membranous (skin, nerves, vessels and brain) from semen—*partes sanguineæ* and *partes spermaticæ*—*hæmatogenous* tissues are capable of regeneration, *spermatogenous* (with the exception of veins) are not. Galen opposed the view that the heart is the first formed organ, on theoretical grounds assigning that position to the liver. The structure of organs is described in detail. It is noteworthy that Galen gives fairly correct descriptions of the junction of the umbilical veins with branches of the portal vein, and the umbilical with the iliac arteries, of the foramen ovale with its membranous valve, and gives an excellent account of the ductus Arantii and ductus Botalli—facts that were later discovered anew.

Parturition takes place through uterine contractions, abdominal pressure and active opening of the os uteri; lacteal secretion is the result of pressure by the enlarged uterus upon the abdominal vessels, which are in communication with the arteries of the breast.

In spite of obscurities, such as are always attendant upon half-truths or errors, the isolated facts in anatomy and physiology as conceived by Galen may be united to form a fairly coherent whole.

Design, as manifested in its structure and vital phenomena, is the animating principle which controls the activities of the organism; the forces subservient to it determine the course and measure of material changes; structure is from the first adapted to physiological function; the act of respiration, which admits *pneuma* and modifies body-warmth, excites the vital processes to action. *Pneuma*, introduced from without, inherent warmth and the four cardinal humours constitute the essentials of the human body; liver, heart and brain are the seats of origin of the *spiritus naturalis*, *vitalis* and *animalis*, the sources of blood, warmth and power of movement and sensation. Veins as conduits of blood, arteries as transmitters of *pneuma*, nerves as instruments of sensibility and motility, unite centres with periphery; every part of the body is, in its action, dependent upon the harmony of the whole and independently withdraws from the stream of nourishment by means of a specific power of attraction those ingredients necessary to it. In each of the three digestions, in the intestine (*chylosis*), in the liver (*hæmatosis*), and in the organs (*homoiosis*), certain waste products are formed, destined for excretion (to which belong the excrements, black bile, urine and sweat).

Galen's conception of life is that it consists merely of the sum-total of organic movements, induced and maintained by external influences

—the aggregation of functions. The harmonious operation of organic functions can only take place, however, when the material structure is normal. Symmetry of constitution, normal blending of primary component parts and of their qualities forms, therefore, the essential condition for health, a perfectly uniform blending being the ideal. External influences, mode of life, age, sex and individuality produce a constant oscillation about the centre of gravity, call forth a transient, more or less decided preponderance of one or other of the four humours (four temperaments, sanguine, choleric, phlegmatic and melancholic), so that man, strictly speaking, lives constantly in a state of more or less unstable equilibrium (idiosyncrasy). So long as this does not make itself felt by a disturbance of function or pain, so long as well-being, *euxia*, exists, the individual case may be referred to as one of health, a condition depending upon a normal relationship of solid and fluid parts. Alteration in composition of the fluid, or in condition of the solid, *i.e.* the disturbance of function which results, determines the existence of sickness. Galen made a somewhat subtle distinction, founded nevertheless upon his medical experience, of an intermediate stage between sickness and health, whence he thus defines medicine: *ιατρική ἐστὶν ἐπιστήμη ὑγιαίνων καὶ νοσούντων καὶ οὐδέτερον*.

It was a most important advance in medical thought that Galen should have recognised the significance of a transitional state preliminary to the onset of sickness, should first have grasped the importance of predisposition to disease (evidenced by constitution and temperament) and should clearly have enunciated it.

In Galen's pathology all those views are united, and their contradictions recognised, which formerly had been upheld with extravagance and partiality. A foremost place is indeed occupied by the theory of humours and qualities, next to which in esteem were held the doctrine of *pneuma* and the theory of *plethora* (Erasistrateans), whilst the localised pathological, anatomical point of view, and even the *strictum* and *laxum* of the hated methodists were not neglected. Diseases fall into the following categories:

1. Diseases of the four humours (phlegm, blood, yellow and black bile).
2. Those of the homogeneous parts (tissues).
3. Diseases of the organs (local pathology).

The diseases of the homogeneous parts may consist either in a disproportion of the qualities (preponderance of warm, cold, dry or moist) or in abnormal mechanical conditions, *i.e.* relaxation (*laxum*) or increased tension (*strictum*). Diseases of the organs are caused by their alteration in structure, number, extent, position, or by solution of their continuity.

Galen, following the pneumatists, modified the Hippocratic doctrine

of crasis, distinguishing, according to the preponderance of either one alone or two of the qualities (elements) as attributes of the corresponding primary humours, eight dyscrasiæ, viz. the warm, cold, moist and dry, the warm-moist, warm-dry, cold-moist and cold-dry (cf. p. 225).

Of great importance was the fact that he assigned a far more prominent rôle to the qualitative (impurity) and quantitative (plethora) anomalies of the blood than to abnormal conditions of the other humours, whereby a way was paved for the transition from humoral to hæmo-pathology. The pneumatic theory, for instance, is transformed into that of fever and inflammation. With a marked predilection for the fine-drawn distinctions of the stoics and pneumatists (cf. p. 226) this systematic thinker brought much needed order into the doctrine of disease-processes and into ætiology, where immediate and remote causes were frequently intermingled in confusion, and symptoms mistaken for actual morbid processes. The incidence of diseases is determined by adverse external influences, acting as immediate causes (*αἰτίαι προκαταρκτικαί*) upon an already existent disposition (predisposing causes); the sum total of morbid processes is *διάθεσις*. In disease, which in its essence represents abnormal movement, four things are to be distinguished: 1. The direct causes of the abnormal movement (e.g. absolute and relative plethora, deficiency of humours, morbid condition of humours, *αἰτίαι προηγούμεναι*). 2. The abnormal movements themselves, i.e. disturbance of vital processes (*πάθος*). 3. The effects upon the diseased parts resulting from the latter, disease in the strict sense of the term (*νόσημα*). 4. The symptoms. The last are partly direct disturbances of function, partly secondary manifestations (e.g. fever), partly changes in secretion and excretion. According to another view they are to be divided into essential (*παθογνωμονικά*) and accessory; the former constitute the expression of the primary morbid condition, the latter are called forth by the nature, degree, etc. of the ailment.

Diseases may be very acute, acute and chronic (*κατόξεια, ὀξεία, χρόνια*), the last arising chiefly from disorders of phlegm and black bile, the others from anomalies of yellow bile and blood. The stages of disease are beginning (*ἀρχή*), increase (*ἐπίδοσις*), height (*ἀκμή*) and decrease (*παρακμή*), but these are not observable under all circumstances. In relation to chronic affections Galen rejected the old Hippocratic division of disease into stages of crudity, coction and crisis; nevertheless it was not from inconsistency on his part that he should have maintained the coction of humours, crisis and lysis. The doctrine of critical days, in particular, developed into a complete system, which long held its own, the most important day being the seventh.

The doctrine of critical days had not taken final shape in the *Corpus Hippocraticum*, although in the *Aphorisms* preference was given to the uneven ones. Mention is made there of the "dies indicativi," particularly of the fourth as indicating crisis on the seventh day, further of the eleventh which indicates the fourteenth, of the seventeenth which indicates the twentieth as the critical day. In acute illnesses the fourteenth and fortieth days are variously given as decisive. In subsequent literature there arose both supporters and opponents of this doctrine, Aesclepiades and the methodists in particular rejecting the entire theory, and maintaining that crisis could occur upon any day. Celsus ridiculed the numerical arrangement and pointed out many contradictions. Galen declares the seventh day to be the one upon which the most momentous and favourable decisions occur, being heralded by the fourth through the nature of the urine, sputum, fæces, etc. On the sixth day crises are few and mostly dangerous, as indicated by a turn for the worse on the fourth day.

In the fourth Hippocratic book "Upon Diseases" (chap. xv.) the cause given for the decisive influence on ailments of the odd-numbered days is "that on the even days the body attracts fluid from the stomach, but on the uneven days gives up fluid to it." Galen attributes the arithmetical regularity of the course of disease, not to numbers *per se*, but to the influence of the heavenly bodies; the moon being the determining influence for acute, the sun for chronic ailments. "All earthly things are influenced, not by numbers, but by the moon." In this respect the greatest influence is exerted by new and full moons, the other phases are less potent; next in order of importance is the position of the moon in the individual signs of the zodiac. He states definitely that he recognises the truth of the Egyptian astronomers' views concerning the influence of the moon on sick and sound. It may be mentioned that the founder of the geocentric system, Ptolemy, transferred the doctrine of critical days to the domain of astrology, to the great loss of later medicine.

In emulation of the Coan school Galen paid particular attention to prognosis, and he owed not the least part of his fame as a practitioner to accurate predictions; the clinical histories that he relates chiefly serve to throw light upon his outstanding capacity in this direction. Galen also declared the prognostic dicta of the Hippocratic writings to be infallible and, contrary to the spirit of the Coan, who always acknowledged his errors, sought by subtlety to reconcile all contradictions. His anatomical knowledge and his logical mind forced him, however, to seek, where possible, a scientific foundation for his prognosis, in other words, to base it upon diagnosis.

Galenical semeiology attached due value to most of the methods of observation and investigation which antiquity had developed, especial attention being paid to examination of the pulse and inspection of the urine.

The only mention of auscultation is in a reference to the hissing noise heard in cases of penetrating wounds of the chest. Great attention is paid to the secretions (such as the saliva) and excretions. Galen's sphygmology follows the traditions of Herophilos and the pneumatists. Sub-varieties are recognised in the categories of dimension, rapidity, force, tension, frequency, volume, regularity and rhythm.

The foundation of Galenical pathology and diagnosis may be summed

up in the saying that there is no disturbance of function without organic lesion, *μηδέποτε βλάπτεσθαι μηδεμίαν ἐνεργείαν ἄνευ τοῦ πεπονθέναι τὸ ποιοῦν αὐτὴν μόριον*. Investigation was called for in each individual case to determine which organ, primarily or by sympathy, was the cause of the functional disturbance, and which humoral anomaly underlay it.

The theory of inflammation and fever may here be shortly described, since it affords the readiest insight into Galenical pathology. Inflammation belongs to the class of morbid swellings (*ὄγκοι παρὰ φύσιν*, *tumores præter naturam*), and is characterised by local elevation of temperature. Except in the "dry" forms, there results an increased afflux (*error loci*) of *pneuma* or of the four humours (*ρῆυμα*), whereby arise the pneumatic, phlegmonous (blood), œdematous (phlegm), erysipelatous (yellow bile) or scirrhus (black bile) varieties of inflammation. Stagnation of the humours brings about the four cardinal symptoms (*tumor, robor, calor, dolor functio læsa*). The result may be: disintegration, exudation of serum (*ἰχωρ*), suppuration, or corruption (*σῆψις*).

Fever is an abnormal, general elevation of temperature and is due to blocking of the arteries, local inflammation, or corruption of the humours. Fevers are continuous and intermittent: *ague* is held to be due to an affection of the nerve centres. Continuous fevers, of which several kinds are distinguished, are caused, sometimes by stagnation of *pneuma* (*ephemera*), sometimes by corruption of humours, or have their origin in the solid parts (*ἐκτικοὶ πυρετοί*). Of the intermittent fevers (*διαλείποντες πυρετοί*) the quotidian arise from an accumulation of phlegm, the tertian from yellow, the quartan from black bile. Galen, in his fever-lore, based himself on the teaching of the pneumatic school. His division is therefore found in the writings of a later adherent of this school, Alexander of Aphrodisias. Like Galen, he also divides fevers into intermittent and continuous, slow and quick, one day, seven day and hectic.

As Galen in his writings, unlike Hippocrates, has always in his mind rather the upholding of his theories than the recording of unbiassed observations, they contain subtle analyses of morbid processes, but rarely complete pictures of syndromes. Nevertheless special pathology is well represented and in the chaff of irresponsible speculation there is hidden many a grain of genuine observation and surprisingly clear insight.

DISEASES OF THE RESPIRATORY ORGANS

Affections of the nose.—The conception of *catarrh* is in accordance with the doctrine that the brain secretes phlegm. Either mentioned or indicated are: *anosmia*, ulceration and *polypi* (treated by surgical means), *ozæna* and *epistaxis* (treatment by applications of cold to the forehead, tamponage with sponge, leeches to the liver or spleen areas). The relation of *epistaxis* to general diseases was known.

Affections of the larynx.—Galen knew that *aphonia* and alteration of the voice could be caused by trauma (cerebral lesions, lesions of the spinal cord, thorax and abdomen), as well as by local affections of the larynx. Foreign bodies in the larynx or dryness of the mucous membrane cause cough by their irritation. Descriptions are given of ulcers in the larynx (superficial and deep; they are little painful), various forms of *laryngitis*, relaxation of the vocal cords. *Cynanche* is to be distinguished from *synanche*; the former attacks the interior of the larynx and is most dangerous, whilst the latter attacks the pharynx. In treatment, demulcents (gum, mucilage, milk, eggs etc.), purifying (expectorant) and astringent

remedies are used, as well as "hypoglottides" (small bean-shaped pellets, which were placed beneath the tongue, slowly dissolved and swallowed). Dietetic régime, baths, air-cures and venesection in inflammatory affections were also in use.

Diseases of the lungs.—The therapeutics of acute bronchitis consisted in the exhibition of honey (to assist expectoration) and opium with boiled grape-juice, narcotics in conjunction with pepper, galbanum and especially marrubium vulgare. He distinguished, much more sharply than his predecessors, pneumonia from pleurisy and noted as differential diagnostic signs of the former greater dyspnœa and bloody sputum. Pleurisy was defined as νόσσημα τοῦ τὰς πλευρὰς ὑποζωκότος ὑμένος or as φλεγμονή of this membrane. In pneumonia attention is to be paid to the varying appearance of the sputum in different stages, to the pulse and respiration. The nature of the sputum indicates the humour, afflux of which is causing inflammation; green, black or foul smelling excreta are of unfavourable import. The pulse may be full, undulant, extremely frequent, at times hardly perceptible, irregular or reduplicated; pulsus intercurrents betokens danger. Breathing is oppressed, rapid and superficial; the greater the obstruction to the air passages, the greater the dyspnœa. In pleurisy the pain has a stabbing character; the pulse is quick, frequent, of medium size, forcible and hard; the arteries are tense and hard. In order to distinguish it from disorder of the liver, attention should be paid to the stools, which present characteristic peculiarities in the latter case. The treatment of the two complaints is, in the main, identical; in addition to poultices the chief part is played by blood-letting (from the arm veins on the affected side until the blood comes off a healthy red) and purgation (with colocynth and hellebore). Diarrhœa (held to be of bad omen) is an indication for opium, hyoscyamus and diuretics, following the evacuations honey-water, infusions, light diet and wine, especially when excretion is scanty. The diagnosis and therapeusis of empyema (collection between lung and chest wall) is less fully treated by Galen than by Hippocrates. Of phthisis Galen distinguished an inflammatory and ulcerative, and an insidious variety. *φύματα*, of which he, following Hippocrates, speaks repeatedly, do not signify tubercles but ulcers or collections of pus in the lungs. Ætiological considerations in the inflammatory variety are, mechanical lesions, laceration of the tissue of the lung, continued coughing and hæmoptysis, this being the most important cause of phthisis. The bleeding occurs: 1. Through rupture of vessels (as a result of mechanical injury, blow, fall, lifting heavy weight, loud cry). 2. By erosion of the vessel walls. 3. By atony of the vessel walls, which causes the "anastomoses" to allow the blood fluids to penetrate. Differential diagnosis from hæmatemesis is established by the fact that vomited blood is dark in colour, and is voided without coughing, whereas blood coming from the lungs appears bright and frothy and is expectorated by coughing. If the hæmoptysis originates through rupture of vessels, venesection is to be undertaken in young people, provided the patient does not suffer from excess of bile. Other recommendations are, bandaging of the limbs, inunction, dietetic regimen (barley water, fruit, rest), treacle, to promote sleep as well as to reduce secretion. The creeping form of phthisis results from abnormalities of the humours. The pulse is small, weak, soft, quick and "hectic." Of bad prognosis are salt-flavoured sputum, diarrhœa and loss of hair. Treatment consists in easily digested, strengthening nourishment, continuous consumption of milk, relief of constipation, and finally in the employment of various remedies, mostly of a balsamic and astringent nature (myrrh, turpentine, Armenian bolus) or of antidotes (*e.g.* foxes' lungs). The best curative agent, however, is, according to Galen, change of air (land or sea voyage), residence in dry and elevated localities, in Egypt and Libya. A particular fame as a health resort was enjoyed by Tabiæ, lying south of Vesuvius, on the bay between Sorrento and Naples, the advantages of which Galen describes in detail and endeavours to prove by clinical histories of consumptive patients. It is a remarkable fact that Galen was aware of the infectious nature of phthisis, for he says "consumptives emit foul emanations into the room they inhabit and a foetid odour. It is a matter of experience that those who sleep in the

same bed with consumptives fall into consumption, also those who live long with them, eat and drink with them, or wear their clothes and linen, before their dangerous qualities are removed." For "palpitation" Galen recommended blood-letting and strict diet.

Diseases of the digestive apparatus.—With regard to the elucidation of symptomatology we find the following in Galen. Loss of appetite is due to the fact that undigested substances, bilious humours or phlegm are present in the stomach, or that its functions are weakened. The sense of hunger depends upon cold and dryness and has its seat in the "cardiac orifice" (the expression *cardia* or *stomachos* stands for the *œsophagus*; the *cardia* was supposed to be very rich in sensory nerves and thus the starting-point of many morbid conditions). *Bulimia* ensues when acrid, morbid humours irritate the stomach, when the ingested food is too rapidly distributed throughout the body, but particularly under the influence of external cold or cold dyscrasias whereby the inner coat of the stomach becomes contracted. Thirst is also situated in the *cardia* and is increased when the stomach is filled with bilious or salt matters. Nausea, also starting from the *cardia*, does not always lead to vomiting, nausea being the ineffectual, vomiting the successful attempt of nature to purify the stomach from harmful substances. This occurs by means of the "expelling force." Nausea is induced when bile preponderates in the stomach and the *cardia* takes on a bitter character, vomiting when the stomach is weakened and its upper part irritated by the amount or indigestibility of the food. Retching and vomiting occur, not only as an accompaniment of stomach and abdominal trouble and obstruction, but also with sudden fright, mental disorder, injury to the brain and its membranes and sea-sickness. The vomiting of infants is also mentioned by Galen. Vomited material is of variable nature, sometimes resembling coagulated blood. Hiccough, to which children are especially liable, results from fulness or emptiness of the stomach, or when it contains acrid, heating juices, and particularly through cold to the *cardia*, of which it is a cramplike affection. It may also be produced through inflammation of the abdominal organs (pressure on the stomach); one of the methods of treatment recommended is holding the breath.

Dyspepsia was treated by Galen with emetics, by covering the head and stomach area with hot cloths, twenty-four hours' fasting, under certain conditions cold compresses to the epigastrium, cold drinks and ice; severe vomiting was treated with vegetable astringents, finally with opium and aromatics. The so-called "*morbis cardiacus*"—frequently mentioned by the ancient medical authors, and probably a neurosis—was considered by Galen to be an acute illness originating in the stomach. Amongst the intestinal affections were included catarrh, colic, *volvulus*, dysentery, *cholera nostras*, whilst intestinal parasites were described in detail. Colic—which Galen held to be unfittingly named since its point of origin was not only the colon but any other part of the abdomen—frequently precedes dyspeptic trouble, nausea, vomiting, etc., is often connected with obstruction and vomiting, occasionally with dyspnoea, rigor and sweating, runs its course without fever and may cause loss of consciousness. The duration of the attack may be two days; not uncommonly there is interchange with other complaints, e.g. with disease of the kidney, in the latter case the passage of calculi in the urine constitutes a point in differential diagnosis. The cause of true dysentery he seeks in intestinal ulceration, but there are also varieties customarily called dysentery which are characterised by *melæna* without ulceration. Weather and temperature (spring and summer, as well as drinking water out of bronze conduit pipes) have great influence upon the incidence of dysentery; ulceration also occurs when the inner surface of the intestine is eroded by morbid juices; if the stools have an ichorous appearance, the presence of cancerous ulceration may be suspected. Remedies are oyster-shells, hartshorn, opium, galls and clysters. Cholera is characterised by its highly acute nature, sural cramps, threadlike pulse, whilst in the later stages unconsciousness occurs. Intestinal worms are formed in the human body from putrifying material under the influence of bodily warmth. Jaundice is the result of obstruction to the bile-duct, inflamma-

tion or tumours and is not a disease but a symptom. If it occurs as a critical sign during the course of a disease, treatment consists in warm baths and friction, as a local complaint it is treated with purgatives, diaphoretics and diuretics. The liver, says Galen, is on account of its structure and physiological activity particularly prone to obstruction, the more so if its vessels are narrow. The consumption of indigestible foods, raw juices etc. are exciting causes. Inflammations of the liver upon the convex side involve the respiratory system, those upon the concave side rather the organs of digestion; to such symptoms hiccough also belongs. Anasarca is caused by excess of cold and moist or unwholesome matters which produce liquefaction of the flesh; dropsy results from affections of the liver, spleen, kidneys, lungs and intestines, from retention of menses and hæmorrhoids. Ascites produces disturbance of respiration and cough by upward pressure of the collection of fluid upon the diaphragm, as well as secondary compression of the lung. The pulse in ascites is small, frequent, rather hard and of somewhat high tension, in anasarca it is undulant, fuller and weaker.

Diseases of the uro-genital system.—Deficiency of urinary secretion shows three degrees of intensity: dysuria is the slightest form, strangury consists in the passage of urine drop by drop, ischuria is its complete suppression. The cause consists in obstruction to the urinary passages (through over-thick urine, coagulated blood, stony concretions), in inflammation or paralysis of the bladder, in the irritative quality of the urine. Dysuria may also occur without any disease of the urinary organs. In long-standing retention Galen counselled the use of the catheter, bent into an S-shape to empty the bladder. Inflammations of the kidneys are apt to be protracted ailments which may last throughout life. Renal calculi have the same origin as gouty deposits in the joints; vesical calculi occur chiefly in boys. The therapeutics of urinary calculi and gout demanded the use of asses' milk, wine with honey as a diuretic, and as drugs: myrrh, parsley, caraway, ammoniacum and the powder found in sponges. Alum is useful in hæmaturia, opium in ischuria. Canker of the bladder (*psora*) was a condition in which the urine was thick and contained branny scales (chronic cystitis). Renal colic was easily to be confused with intestinal colic, but the use of purgatives served as a distinction. Galen held diabetes, the nature of which was only deduced from the polyuria, to be due to a loosening of the kidneys. The term "gonorrhœa" signifies involuntary emissions, according to their association with erection or the contrary they were held to be irritative or paralytic phenomena. Satyriasis or priapism is the permanent swelling and enlargement of the penis.

Dyscrasie and cachexie.—Of gout Galen believed that it is produced by thick and morbid humours, and that it is often hereditary; gouty deposits are consequent upon a dessication of the thick humour; diarrhœa and varices often exercise a favourable influence upon the course of the disease. Blood-letting and purgation have a prophylactic influence, but are only suitable for the plethoric. The gouty attack is to be treated by irritating, blistering poultices, with narcotics and afterwards resolving plasters. Rheumatic affections are carefully separated by Galen from arthritis. Cancer he considers as of a parasitic nature.

Nervous diseases.—It is natural that those diseases which owe their origin to a morbid state of the nervous system should only in part have been recognised as such by Galen. Headache is caused by humoral anomalies, but also by strong odours, drinking unwholesome water, or by the penetration of air into veins. The chronic form of headache was known to the ancients as *cephalæa*. Hemicrania may be primary or secondary and due to abdominal affections, morbid humours and gases, entering the veins and penetrating to the head, the pain itself arises in the ventricles of the brain. Vertigo is mostly of cerebral origin. Apoplexy, *i.e.* total loss of power of movement and sensation, with loss of consciousness, is caused by plethora and accumulation of phlegm in the ventricles and substance of the brain. Respiratory paralysis leads to death. The paralysis following the actual apoplectic attack is called paraplegia. Hemiplegia (the law of crossed paralyzes was naturally known to Galen) and facial paralysis point to the brain as seat of disease, all other paralyzes are

due to lesion of the cord or nerves. Cramps are due to anæmia or plethora of the central nervous system. Paralysis of the facial nerve was known as "spasmus cynicus." Epilepsy is caused by obstruction of the cavities of the brain with phlegm or black bile; its name "disease of Hercules" was due to the power of the disease; its name of "children's disease" was due to the fact that it commonly occurred in children. Its treatment consisted in venesection, undertaken upon the foot, in the administration of treacle, and in dietetic measures. A special treatise by Galen dealt with the different forms of tremor.

Psychoses.—In the pathology of the ancients a prominent place among disease-types was occupied by "Phrenitis," "Lethargy" and "Typhomania." These do not represent definite diseases, but psychical anomalies occurring in the course of diseases. Phrenitis is a feverish condition of mental excitement associated with delirium which, as a symptom, may be a manifestation of many ailments. The seat of the disease lies in the brain and, in particular, in the meninges, which are heated by the determination to them of bilious blood. Treatment: venesection, cold compresses and cold affusions. Lethargy is also localised in the meninges, but here sluggish phlegm is the exciting cause. Galen describes this disease as running its course quickly and as very dangerous; characteristic is the suppression of intellectual activity, and somnolence. Lethargy and phrenitis stand in mutual inter-relationship in so far as the former precedes the latter or follows upon it. Lethargy may be considered as an acute feverish condition with pronounced weakness and somnolence. In between these two "diseases" stands typhomania, which unites in itself certain symptoms of each. Melancholia may occur in two forms, in one of which the whole mass of blood is affected, in the other, only that of the brain; in the former variety blood-letting is an important part of the cure. Predisposing causes are, *e.g.* arrest of menstruation, absence of sexual intercourse, grief, worry etc. It may also ensue as a result of sunstroke, acute illness etc. Mania owes its origin to thin, bilious humours and is distinguished from phrenitis only through the lack of fever. Galen's psychiatric symptomatology distinguishes disturbances of the faculties of reason, imagination and memory, as, for instance, in the realm of imagination, complete incapacity (*ἄνοια*), lack of activity (*μωρία*) and perverted activity (*παραφροσύνη*).

Dermatology.—The theory of skin diseases rested upon the old conception that dermatoses—of which many varieties were known—were not diseases *sui generis*, but external expressions of internal conditions; the division into those of the head and those of the rest of the body constitutes the first attempt at systematisation. Galen placed upon gout the responsibility for the production of many skin lesions. In correspondence with this idea the treatment included, not only topical, but also internal remedies, particularly purgatives such as hellebore.

Experience alone is the touchstone of a medical system, and nothing so distinctly proves the love of truth and ripeness of judgment of an investigator as his recognition of, and respect for the limitations in clinical medicine beyond which his pathological deductions will not take him, and his employment of provisional empiricism where an exact scientific basis is wanting, and this in spite of his leaning towards causality.

If we consider Galenical therapeutics from this point of view we find that the great physician in no way neglected the empirical for the dogmatic standpoint, in many respects he even gave preference to the former. In principle he wished to follow on the lines of Hippocrates, making it his ambition to base, where possible, his empirical treatment upon "scientific" foundations and to set it well-defined limits. The over-confidence in the

possibility of this was doubtless at the root of many mistakes, restricted the activity of Hippocratism and may even be said to have brought about a method of treatment which was often Hippocratic only in form. Galen clearly and comprehensively expounded the duties and principles of the medical calling, formally embracing the views of Hippocrates.

He offers excellent advice concerning behaviour in the sick-room: visits should not be paid untimely nor too often, they should not be burdensome through noise or loud speech, the physician should, to a certain extent, accommodate himself to the patient's level of education, to his inclination and habits. Tactless speeches are to be guarded against, *e.g.* "Patroclus is dead and he was a more important man than thou art." As an example to be avoided the great Cointos is mentioned, who smelt strongly of wine and retorted to a fever patient in an important house who complained of this, "What then, thy fever smells worse."

General therapeutics reach their highest level in a full recognition of the healing powers of nature (physiatry). It is the duty of the physician to assist the physis in its curative endeavour, as Hippocrates said, to do good or at least to do no harm, *ὠφελεῖν ἢ μὴ βλάπτειν*.

Galen points out very clearly that this saying of Hippocrates is fully comprehensible only to the experienced practitioner, for he has acquired insight into the difficulty, under certain circumstances and with the best intentions, of avoiding harm. "For, if it happen by chance that through the unsuitable use of a drastic remedy you lose a patient, you will then understand the full importance of this Hippocratic saying."

The essence of Galenism, as contrasted with Hippocratism, consists, however, in the attempt to establish the theory of the physis and its sphere of influence, and thus to give the physician, through general principles, a reliable guide for his procedure in any individual case.

A pathology founded upon natural philosophy, the sister sciences and clinical observation promised to assure recognition of the causes and phenomena of disease. The latter are only disturbances of function, their removal constitutes cure. The instruments of which the physis makes use to this end can only be those forces which, acting in health and according to the law of necessity, effect the development, nourishment and growth of the body. Of these the "expelling" force is the most important since it leads to removal of the *materia peccans*. Without combating the attractive, restraining and alterative force, the physician should concentrate his chief attention upon the evacuation of noxious substances. A second fundamental law of therapeutics is the combating of disease by remedies exercising counteracting influences (*e.g.* cold by warmth, plethora by deprivation). The choice, the dosage and method of application of remedial measures are subordinate to well-defined indications (*ἐνδείξεις*), which are inferred from the causes of the disease and from its nature and symptoms, from the individuality and habits of

the patient. The causes of the disease are, where possible, to be avoided by the employment of prophylactic measures (*indicatio causalis prophylactica*). Indications for treatment (*indicatio morbi*) are dependent upon the character and intensity of the disease, its type and stage, its outcome and complications. Thus, for instance, drastic measures are only advisable in early and late stages. Symptoms (*indicatio symptomata*) may demand, for instance, lessening of pain, regulation of evacuations, averting of dangerous conditions (*indicatio vitalis*). With reference to the individuality of the patient, age, sex, temperament, strength, place of residence and peculiarity of the diseased organ have to be taken into consideration. To these are added indications or contra-indications derived from the atmosphere or even from dreams. Before inaugurating any therapeutic method it must first be decided whether the complaint be curable or not, and the treatment must always be both general and individualising. Galen's methods give due value to dietetic and physical means as well as to medicinal.

Appreciative of the experience of his predecessors—Hippocratists, methodists, pneumatists—Galen devoted his best attention to dietetics and gymnastics, giving the most precise directions, including the minutest details, for the application of these measures. He turned the influence of air and light, of cold and warmth to therapeutic account; he made extensive and thoughtfully regulated use of massage, of baths of all kinds and finally of climato-therapy, which latter he expanded into the system of treatment by altitude (in phthisis combined with milk-cure).

Galen has treated of dietetics in the most thorough manner. His work upon "Diet for attenuation of the humours" is a model. He here says at the outset that in certain chronic affections little can be achieved with drugs, whilst a rightly chosen diet may in such diseases produce improvement or even cure (inflammation of the kidneys, gout, asthma, spleen and liver enlargements, epilepsy). "Only here, and in other cases, the physician requires guidance in order to discover the psychological moment and the necessary degree." The writing goes on to enumerate a large number of useful food materials, which coincide remarkably with our present-day experience. Galen enjoined bodily exercise and occupation in the open air upon the weak and convalescent, particularly rowing, digging, mowing, throwing the javelin, running, jumping, riding, hunting, splitting wood, carrying burdens etc. Gymnastic exercises were held to be particularly successful in cases of adiposity and in irritated conditions of the genitals. The most detailed rules are laid down concerning the technique of bathing. In addition to water baths Galen employed steam, sun, sand, mineral and herbal baths.

In accordance with humoral pathology those measures played a prominent rôle in Galenical therapy which had for their object the evacuation of superfluous or noxious humours, likewise blood-letting (venesection, leeches), laxatives, emetics, diuretics, diaphoretics. In blood-letting

Galen purposed either withdrawal of the humours, ἀντίσπασις, revulsio, or else obviation of already existent stagnation of the humours, παροχέτευσις, derivatio; the former was undertaken upon parts of the body lying at a distance from the seat of the disease, the latter upon those near to it; the former was effected by venesection, mostly upon the sound side, the latter by cupping, leeches or also by venesection. The chief indications for blood-letting were plethora, acute inflammations, high fever and great pain. Galen forbade blood-letting in children under fourteen and in old people except in emergencies. He also discouraged over-use of this operation since the excessive loss of blood leads to general weakness, œdema, paralyses and even mental disturbance; attention was to be paid to the general condition, age, nature of illness, time of year and climate. Thus, for instance, in continuous fever the indication only held good for young and vigorous patients; blood-letting was better borne in spring and autumn than at other times of the year; in the case of northerners and southerners greater care was called for than with Greeks and Romans. Except in cases of plethora Galen withdrew blood until faintness ensued. As a restorative, bandaging the limbs was practised. Cupping was employed in inflammations of the eyes, epistaxis, amenorrhœa and metrorrhagia.

Following the fashion of his day and complying only too readily with the wishes of the multitude, Galen added to the number of drugs in use in an extravagant and not always advantageous manner. Amplifying the work of his predecessors, he bequeathed in his writings a mass of often highly complicated formulæ of all kinds, which obscured his rational dietetic prescriptions and relegated them to oblivion. Although himself only a compiler from material already to hand, he was looked upon by later authors as the father of pharmacy.

Galen, who was the author of the saying "Populus remedia cupit," betrays clearly through his therapeutic zeal the origin of his earliest instruction at the hands of the empirics. In his employment of medicaments he was to a certain extent guided by clinical experience, but for the most part he impressed upon the art of therapeutics the characteristic stamp of his speculative trend of thought, deducing his pharmaco-dynamics from the doctrine of elementary qualities and providing an apparently exact basis for dosology by means of fine-spun theories—giving this the appearance of being the keystone of his system.

Galen defines medicaments as substances which, in contra-distinction to food, give rise to certain changes in the organism, and he divides them into three classes. To the first belong those drugs which exert their

influence exclusively through the elementary qualities of warm, cold, dry and moist. To the second belong those which exercise their activity through the secondary qualities (cf. p. 252) and which produce principal and accessory effects; these are sour, bitter, sharp, acid, astringent, relaxing remedies. Thus bitter and sweet remedies are at the same time warm, sour are also cold. To the third class belong those drugs which (in a manner not further explicable) act, by virtue of the substance as a whole (cf. p. 252), and by virtue of the third qualities, astringents, purgatives, antidotes etc., whilst also exerting a specific action upon certain organs. This fundamental division, however, required a further differentiation which was made possible by introduction of the conception of actuality and potentiality and by gradation of the modes of operation. Thus the elementary quality hot is manifested not only in fire, but also, for instance, in pepper; in the former "actu," in the latter only "potentia." Also, although in the manifold medicaments one or other elementary quality is always present, yet the intensity of this elementary peculiarity varies. In pursuance of his idea Galen depicts four degrees of intensity of operation, four stages of activity. The first degree includes those medicinal agents which produce slight, barely perceptible effects; the second such as have a distinct action; those of the third section have a drastic; those of the fourth a destructive effect. The narcotic poisons, such as opium, mandragora, conium, are cold in the fourth degree; such as crowfoot, euphorium, are hot in the fourth degree; the rose is cooling in the second degree etc. It is unnecessary here to follow the subdivisions further, but it may be pointed out that this gradation made possible strictly individualising medicinal treatment based on the principle *contraria contrariis* (combating the most prominent elementary quality by its opposite), as well as a most subtle system of dosage of medicinal compounds.

Compared with pathology and the therapeutics of internal diseases the surgical branches with Galen were backward. As surgeon to gladiators in his own home he had opportunity of accumulating varied experience, but in Rome he appears—in accordance with the tendency to specialisation—not to have acted as a surgeon save in consultation and under exceptional circumstances. Theoretically at least, he was actively interested in surgery, and bequeathed much of value in his writings (*e.g.* upon bandaging, treatment of wounds, arrest of hæmorrhage, suture, various operations). For purposes of demonstration he made use of little models (*e.g.* of the Hippocratic bench, extension apparatus). His thesis upon ophthalmology has unfortunately perished.

Obstetrics is more scantily treated in his works than any other subject.

Galenical surgery made use of a large number of instruments. To these belonged a variety of probes, forceps, knives of different kinds and sizes, lances, hooks, needles, cauteries, chisels, hammers, trephines, raspatories, gouges, bone-forceps, enema and vaginal syringes, tubes, catheters, calculus-forceps etc. For the treatment of wounds and ulcers careful directions were given, attention being paid to the general condition of the patient, (*e.g.* insertion of sutures, partial suture only, under certain conditions; avoidance of pockets, and drainage of the deepest part; destruction of exuberant granulations). Arrest of hæmorrhage was effected by cold, astringents, suture, ligature, torsion or complete severance of (incised) vessels, the cautery; silk or gut served as ligatures. Amongst injuries detailed consideration is given to those of vessels (traumatic aneurysm), of nerves, penetrating wounds of the breast and abdomen, where special measures are enjoined according to the case. The teaching on fractures and dislocations and their treatment shows many advances upon that of the Hippocratists (classification of fractures of the skull, detailed description of trephining). Amputation of gangrenous parts is only occasionally mentioned, resections are more often considered. The case of resection of the sternum with exposure of the heart is celebrated and Galen further describes resection of a rib in empyema (in an experiment on an animal for physiological purposes he performed subperiosteal resection of a portion of the rib). Plastic operations were employed in cases of defects in nose, ears and lips. The description of the treatment of lymphatic glands, varices and fistulæ is excellent.

Obstetrics are not exhaustively treated by Galen, who cannot be said to have surpassed his predecessors in this subject; characteristically he held presentations other than those of the vertex as rare.

He seems to have been better versed in gynæcology; he described inflammation, carcinoma and malposition of the uterus, vaginal discharges, mastitis, carcinoma *mammæ* (radical operation); the causes of sterility were exhaustively investigated.

In ophthalmology, which only finds scanty mention in the extant books—his “Diagnosis of diseases of the eye” has been lost—Galen explains physiologically and in a surprising manner functional disturbances, is familiar with the contagiousnesses of certain inflammations; from the statements upon cataract, which is supposed to be partly in the lens and partly in the humour, it may be deduced that as a rule only couching and depression were practised, although individual surgeons attempted extraction of the cataract after incision.

Otology: Galen left behind him a mass of recipes against different ear-diseases (otorrhœa, abscess, accumulation or lack of wax, tinnitus, deafness, dumbness). Explanation of the symptoms rests mostly upon speculation.

In addition to his medical achievements the greatest credit is due to Galen for his precepts upon hygiene, wherein he shows himself a true Hippocratist. With complete mastery of the subject and due consideration of all circumstances he sets forth in utmost detail the necessary conditions for the acquirement and maintenance of health at every age. Galen included within the scope of his consideration, mode of nourishment, influence of water and air, use of baths, massage, exercises, games etc. and many of his deductions, founded upon acute observation, possess imperishable value, because they culminate in the thought of which the whole beauty and harmony of classic antiquity is the expression—*Μηδὲν ἄγαν*.

The books "De alimentorum facultatibus" in which the individual articles of diet are discussed in relation to their nutritive value and with directions upon their method of preparation, long formed the source of inspiration of all subsequent dietetic authors. In the work "De sanitate tuenda" the hygienic factors are treated in detail. Of games he declared that those were the best which afforded recreation to mind as well as body. This treatise contains a compendium upon the action of baths and the modification of their method of employment.

All that was possible, through comprehension and intellectual penetration, to medical science of the day Galen achieved, and, even though the edifice may have been reared more upon foundations of brilliant fiction than of solid fact, there yet remains no better criterion of the possibilities of the medical organism of antiquity than the great Galenical system, perfected by philosophic reflection and uniting in itself all divergent tendencies. It was the proud boast of its founder that he was the first to pave and make passable the paths Hippocrates had outlined, to do what Trajan did for the military roads of the Roman Empire. Self-complacently and in the belief that he had exhausted the possibilities of investigation he cried: "Whoever seeks fame by deeds, not alone by learned speech, need only become familiar, at small cost of trouble, with all that I have achieved by active research throughout my entire life."

Such over-estimation has frequently been repeated in the course of history, but never have the doctrines of one man exercised so long, unbroken and tyrannical a power over the minds of others as did those of Galen—only equalled in this respect by the geocentric theory of Ptolemy. It would be irrational to hold Galen himself responsible for an intellectual impression lasting well over a thousand years, instead of blaming those who, devoid of any originality, followed in the beaten track and even placed obstacles in the way of free investigation. This is the more true since in Galen's mode of research lay so many seeds only awaiting germination as, for instance, in his experimental method. Instead of holding by his rational ideas and furthering the development of his empirical achievements, his successors accepted Galen's views in every department of medicine as authoritative, thus ever widening the gulf between themselves and true Hippocratism. Herein, unfortunately, the example was set by Galen himself. For although he calls Hippocrates *πῦντων ἀγαθῶν εὑρετής*, because he undertook, by means of yet insufficiently developed sciences, to place the empirical facts of Hippocratism on a scientific basis, because he quickened the original teaching with philosophic doctrines, because, in fact, he established a system, he largely depreciated the value of the richest legacy of Greek medicine, and, through the shadow of his imposing personality, obscured true Hippocratism from the sight of coming generations. Hence it followed, upon the revival of independent inquiry, that the Galenical system, as a transition form, fell to pieces, whilst the intellectual achievements of Hippocrates will remain for all time as the source and inspiration of the healing art.

ANTYLLOS

GALEN'S imposing system constituted the climax of scientific effort in ancient medicine, but in the surgical branches it was not given him to surpass, through his own labours, the achievements of his precursors. In these he had to yield precedence to a physician whose name, honoured also in other subjects, is particularly linked with the surgery of antiquity—Antyllos.

Next to nothing is known of the life of Antyllos, of his works valuable fragments only have survived in the later literature, but what little has escaped the ravages of time reveals the greatness of the man and the surprisingly high degree of development of ancient surgery.

The writings of Antyllos dealt, not only with surgery but, in a magnum opus upon remedies, also with medicine as a whole. Recent investigations prove that Galen made use of Antyllos, who in his works once quotes Archigenes, so that we may place his career as having been in the first half of the second century A.D. Antyllos adhered for the most part to the principles of the pneumatic school which gave to later antiquity its most eminent physicians and, in particular, its best surgeons, and he followed the traditions of an Archigenes, a Heliodorus and a Leonidas (cf. p. 229).

In the fragments extant the following subjects are dealt with: influence of air and soil upon health and disease, hygiene of the dwelling-house, dietetics, gymnastics, balneology and nursing. Admirable instructions are given, although permeated with theoretical arguments, showing traces of the sophistry of the pneumatic school. In nursing Antyllos pays attention to the temperature and lighting of the dwelling and position of the patient. He also regulated the diet in sickness with painful minuteness. In fever he allowed cold water to be drunk. He gives detailed directions as to the use of baths and the indications for their use.

Antyllos not only gave general directions for individual surgical operations, but discussed technical details with a minuteness and a consideration of every conceivable eventuality only possible to a master of practice. Even for blood-letting he gives unusually careful directions, mentions arteriotomy (of the arteries of the neck), cupping, wet and dry, vessels of glass, bronze and horn, leeches, "bdellotomy" (the artificial leech) and divides hæmostatics into such as act through cold, constriction, obstruction, dessication or corrosion.

Antyllos was the author of excellent essays upon the surgery of

abscesses (with directions as to the lines of incision), fistulæ, phimosis, hypospadias, contracture from scars, and tumours (lipoma, atheroma and ganglion). He describes in detail the operation for tracheotomy, considering it as contra-indicated when the bronchi and lungs were involved (his method consisted in a transverse section between the rings of the trachea). He describes plastic operations upon "colobomata" (defects, in particular of eyelids, forehead, nose, ears and cheeks). He also earned lasting fame for his treatment of aneurysm (true and traumatic, treatment by double ligature and incision) and his method of cataract extraction.

MEDICINE IN THE DECLINE OF ANTIQUITY

GENERAL CONDITIONS

THE medical art of antiquity found in Galen at once its fullest and final expression, but the age of the great physician of Pergamos coincided with the commencement of the period of decadence.

The decline of medical science is indicated in those writings which have come down to us from the last centuries of antiquity, although it is doubtless more abrupt in seeming than in reality. Such writings seldom bear witness to any genuine progress; the best of them subsist upon ancient tradition, showing no aspiration after quickening research; more than this, they convey the impression that the Hippocratic art was sick unto death and, at least in the Western Empire, was being choked by the crudest empiricism, by the blindest superstition.

The decay of medicine was part and parcel of the general passing of antiquity, a result of that process of disintegration which had been in activity for centuries and which ended with the dissolution of ancient life and culture, with the cleavage of the Hellenised East from the West, and with the fall of the Western Roman Empire. Science and art could not flourish amid the catastrophic changes in political, social and ethical life, in a transition period full of distractions at home and abroad—*non habet locum res pacis temporibus inquietis*—medicine, however, was especially implicated in the general upheaval, since its own particular domain served at times as the arena wherein was fought the battle of civilisation.

A description of medicine in this period of decay is beset with almost insuperable difficulties, due to the fragmentary character of the technical literature which has been saved from the general collapse, and on account of the manifold external influences which, frequently interwoven in confusion, are only rarely linked together in sequence; here and there may be found, however, insignificant germs which, in distant times, after a long dormant period, exercised the greatest influence upon the regeneration of the art of healing. We must, therefore, pay attention only to those factors which

exercise the most potent influence upon the development of post-Galenical medicine.

The decline of medicine is first heralded in the literature of the third century, although its commencement at a far earlier date is evidenced by Galen's complaints concerning the medical conditions of his day; these, although here and there open to correction, are, on the whole, justified by subsequent events.

Galen's imposing doctrinal system shed a deceptive glamour over his art, which, as early as the second century, was already in a decline, just as the efflorescence of the arts under Hadrian and the trend of philosophy under the Antonines seemed like a revival of true Hellenism, although the old intellectual harmony had long since died away. Galen is rather the echo of a great past than the representative of an epoch incapable of appreciating his high aims; indeed he himself betrays characteristics wholly incompatible with Hippocratic originality and freedom of thought, evidences of civilisation's senility.

By his attempted restoration of Hippocratism and anatomico-physiological investigation Galen sought to raise his colleagues above the level of crude empirical practice and barren sectarian strife, but his efforts remained in his lifetime almost unheeded and ineffective, an abortive undertaking with which similar phenomena in other spheres of culture furnish an analogy. The second century manifests a widespread and conscious gravitation back to a greater past—in religion, art, literature and language—although no real animation, no continuity of ideas was brought about by this attachment to classic antiquity. In spite of sedulous cultivation of arts and sciences, in spite of zealous promotion on the part of princely patrons (memorials, buildings, establishment of educational institutions, libraries etc.), this renaissance, an artificial courtly product, rather than a spontaneous national outgrowth, produced no deep or lasting effect: it was less a revival of the true essence of antiquity than an artificial imitation and combination of ancient forms; seed falling on barren ground, it led to no rejuvenescence of creative power. There was, indeed, a wide and astonishingly many-sided activity in art and science, but there lacked pioneers of intellect who, rising superior to eclecticism, should attain to individuality of attitude, while the dead level of academic conventionality, of courtly, verbose erudition extinguished every spark of genius. Where strict method was the guiding principle, as in astronomy, a Ptolemy could arise; where formal thought was the standard, as in jurisprudence, important progress was made; and, where encyclopædic knowledge, dialectic dexterity and eloquence sufficed, the century had considerable achievements standing to its credit, as in grammar, lexicography, philology, in periegesis (Pausanias), history and biography (Plutarch, Suetonius, Arrian), but particularly in sophistry and rhetoric (Aristides, Fronto). On the other hand poetry was dormant, even so poetically endowed a mind as Apuleius turned to prose for his romance (Cupid and Psyche) and, however admirable the architecture and sculpture of this period may have been, judged by the standard of classic antiquity, they betray brilliant technique rather than creative originality. Philosophy degenerated into moralising worldly wisdom, science suffered from an uncritical mania for compilation, from a consequential activity, from a declamatory effusiveness which can be well seen in the writings of a Gellius, an Athenaios and an Aelianus.

Lucian, the master of satire, makes mock of his own century. We see from his imperishable representations of manners and customs how, beneath a fair surface, were concealed smug hypocrisy, sham erudition and unenlightened credulity. The vicious, extravagant hyper-civilisation of the second century was the herald of the decline in days to come.

The causes of the decadence of ancient medicine are to be sought both in its theory and in its practice. Built upon the quicksand of speculation,

lacking the sure support of exact methods, ancient inquiry inevitably flagged so soon as the stimulus of guiding philosophic thought was insufficient or wholly wanting; its progress, dependent upon the genius of individual outstanding personalities, came to a halt when mediocrity held the field. There was in that era of antiquity a lack of any numerous and receptive class which should ensure the continuity of research and should, by means of laborious specialisation, erect the edifice whose foundations had been laid by the masters. In the prime of classic antiquity really great physicians, imbued with the Hippocratic spirit, gifted with scientific insight, overcame the deficiencies of ways and means and avoided the errors of speculation, but as knowledge advanced these shortcomings made themselves felt even at that time. Eminent masters, indeed, there were, but only few of their pupils were worthy, the majority being content to belong to a doctrinaire sect. Thus it was that the historical course of ancient medicine was one of constant fluctuations, hopeful beginnings being indeed in evidence, but the sustained effort necessary for a systematic development of clinical investigation and anatomico-physiological research being absent. As Hellenic medicine spread throughout the Roman Empire, whilst gaining nothing in intrinsic value from its exponents; as inherited theorems became discredited by fresh experience (diseases previously unknown, numerous new medicaments), so in like proportion did the evil grow, till the average physician stood face to face with the dilemma—either to follow one or other sect through thick and thin, or to give himself up to an unguided empiricism. There was an absence of any system of instruction which should not only hand on traditions and impart knowledge, but should train its disciples to independent, critical observation of facts.

As far as actual practical teaching is concerned, medical education remained essentially at the level which had sufficed for the far simpler requirements of the Hippocratic age, *i.e.*, the students received polyclinic instruction from their teachers in the *Iatreia* or accompanied them upon their visits. The sciences ancillary to medicine were mostly fostered in the higher general educational establishments which were gradually evolved upon the model of Alexandria; even here, however, chief attention was paid to iatrosophistical theorems which only led to hair-splitting argument and subtle dialectic exercises, seldom to genuine technical investigations. Even anatomical teaching, surrounded with sophistries, degenerated, being based solely upon book-learning, or at best upon zootomy and, under the influence of the methodic school, being confined to the barest essentials. No organisation of teachers in the high schools with a common systematic form of instruction seems to have existed. The education of the individual depended upon

many different circumstances, being subject to no state supervision ; as early as the third century, however, a certain striving after improvement in the conditions of instruction can be recognised, in so far as physicians of repute, receiving state salaries, were entrusted with the instruction of students, but this reform came too late, since the scientific spirit was already in process of extinction.

Our knowledge of medical methods of instruction in antiquity is most imperfect, but it appears certain that the Roman state did not exert any direct influence upon them until the late Imperial era, and never made practice dependent upon any proof of capacity.

Apart from private teaching by individual physicians—a custom always prevalent—there early existed in the East, wherever Hellenic influence made itself felt, medical schools, usually affiliated to the institutions for higher general education. Thus the schools of Alexandria, Athens, Antioch and Berytus enjoyed great reputations. Many educational establishments in Gaul attained no less eminence, *e.g.* those in Massilia, Burdigala, Lugdunum, Nemausus, Arelate. As far as Rome is concerned the method of medical demonstration seems to have flourished there, and mention is also made of public disputations, but Rome was less the nursery of science than the greatest market for its wares, Alexander Severus (225-235 A.D.) being the first to appoint special lecture-rooms for physicians in which salaried lecturers gave instruction. Since the teachers in the high schools were doubtless principally erudite theorists (*iatrosophists*), who, in philosophical fashion, discussed subtle problems, the actual practical education probably lay in the hands of those physicians who undertook the instruction of students.

In consequence of the absolute freedom of educational methods and the absence of state supervision of qualifications there existed between those who claimed position as doctors the greatest difference in knowledge and capacity ; whilst the methodist Thessalos considered six months as sufficient for the acquirement of medical knowledge, Galen, who held a wide general education to be a necessity for a physician, demanded eleven years of study. It thus depended upon the zeal of the individual and upon the capacities of his teacher whether the student became a genuine physician or an ignorant charlatan.

A well-regulated course of medical study began early (in the fourteenth or fifteenth year or earlier), demanded a preliminary general education, and included anatomy, physiology, pharmacy, pathology and therapeutics.¹

¹ The most painstaking physicians collected their drugs themselves, but the majority obtained raw materials from dealers, in order to prepare the medicaments from them ; others again, to save themselves trouble, bought their preparations ready compounded, whereby the charlatanism of the drug-vendors was encouraged. Physicians carried with them hand- or travelling-cases, *i.e.* boxes of bronze, containing numerous vessels, and often artistically decorated, *e.g.* with ivory inlay representing Asclepius, Hygieia etc. For the Imperial court and the treasury medicaments were collected in the provinces under the supervision of officials, packed and sent to Rome, where they were stored in special buildings. The wholesale drug-merchants bought their stock partly from the treasury, partly through the direct channels of commerce. Adulteration of every kind was rife, although less on the part of the merchants than on that of the purveyors. An intimate knowledge of *materia medica* and therapeutics was on this account, however, an imperative necessity. It was of particular importance, as Galen pointed out, that imitations and substitutions should be recognised, also that physicians should know what drug could be used to replace unobtainable medicaments (*succedanea*). The household necessities of physicians and laity, particularly in the country, were met by *Euporista*—easily made and easily prepared domestic remedies—whereby the abuse of foreign, rare and costly remedies was counteracted and the way paved for a more popular method of treatment, which was notably favourable to the less wealthy.

The anatomical teaching extended at best to the dissection of animals and demonstrations upon human surface anatomy; drawings may also have served for purposes of instruction. Under the influence of the methodists the majority contented themselves with a familiarity with the names of the parts; theoretical discussion upon their functions constituted the sum and substance of physiological instruction.

Practical clinical teaching was so far taken into consideration that many not only taught their pupils in the *Iatreia*, but allowed these to accompany them upon their visits to patients in order that they might study pathological manifestations by observation and examination and become practically familiar with the methods of treatment. Philostratus tells us how two physicians came into the patients' presence accompanied by more than thirty pupils, and Martial gives expression to the patients' complaint of interference by the crowd of students in the following lines:—

“*Languebam sed tu comitatus protinus ad me
Venisti centum, Symmache, discipulis.
Centum me tetigere manus Aquilone gelatae
Nec habui februm, Symmache, nunc habeo.*”

The most important seats of medical education, public hospitals, were, however, entirely lacking, and the *Iatreia* were but inadequate substitutes for these, being only used transitorily for the reception and after-treatment of patients.

The inadequacy of scientific principles and research methods, coupled with the inefficiency of medical education, brought it about that the quality of the physician of antiquity depended far less upon imparted instruction than upon individual aptitude. So long as only those embraced the profession who answered a distinct call, technical dexterity was often a happy substitute for lack of knowledge, and individual talent could develop itself the more readily since it was trammelled by no conventions. That, however, which in ancient Greece so much furthered the best interests of medicine—the absolute freedom of teacher, taught and calling—became, under the totally different conditions of the Roman world, the source of the decline of medical practice, the cause of scientific and ethical degeneration.

In Rome any one so inclined could declare himself a physician; there were no legal enactments which, complied with, were a guarantee of capacity, and medical responsibility was extremely limited. Like a magnet the capital ever attracted newcomers who hoped to find their fortunes there. In the turmoil of metropolitan life, in the endeavour to achieve success with the public, disinterested research and conscientious practice suffered, whilst the high calling of medicine sank to the level of a trade. The mercantile spirit, quackery and self-advertisement found a favourable soil; success did not always come to the worthiest, but often to him who, by means of polypharmacy and novel or secret methods of cure, understood how to attract attention, whose ethical sensibility did not cause him to hesitate at doubtful procedures. Although fanatical wrangling

between the sects and an overgrown specialisation still made a show of a kind of pseudo-science, although many physicians in public disputations or lectures displayed a futile erudition, in actual life success alone succeeded, and the dividing line between the genuine practitioner and the quack became ever less distinct.

The medical class was made up of elements displaying the greatest variations in respect of origin, education and knowledge, of whom not a few had chosen the profession, not so much for love of the art, as from unworthy mercenary motives. Dilettante medicasters and fraudulent quacks competed against the honest practitioner with equal rights under the law, and gradually the influence of the laity not only determined the repute of the physician, but made itself felt in medical theory and practice. Only surgery remained free from this influence as an inaccessible domain of advanced technique.

Through the inequality of its attainments, the lack of any state examination and the limitation of responsibility, the medical faculty in the Roman Empire constituted a very diversified picture. Rarely can the profession have been so crowded with the half educated, the entirely untrained, and obvious charlatans as was at that time the case. Beside the genuine practitioner and the skilled surgeon stood the meretricious figure of the "iatrosophist" who overwhelmed his listeners with erudite-sounding bombast, whilst lacking knowledge to treat the simplest diseases; moreover, as always in times of hyperculture, specialisation degenerated to a ridiculous level. It did not suffice that in Rome medicine was divorced from surgery,¹ although the representatives of both branches were mutually on the best of terms and called one another into consultation, but there were also eye-doctors, aurists, dentists, hernia-specialists, cutters for stone, gynecologists, dermatologists, etc.

The reason for this specialisation lay certainly less in the possession of any real attainments than in the fact that the exponents had acquired the scantiest practical familiarity with one limited subject in the shortest possible time. Like real charlatans many specialists dealt only with the treatment of individual complaints, *e.g.* dropsy, or else they employed one method only in the treatment of every conceivable complaint, *e.g.* hydro-therapy, massage, gymnastics, wine, milk and herbal cures, etc. Galen describes these performances on the part of specialists, but that matters were no better in Martial's time is proved by one of his epigrams which says: "Cascellius removes or stops bad teeth, Hyginus burns away eyelashes which irritate the eyes, Fannius removes enlarged uvulæ without cutting, Eros eradicates brand-marks from the skins of slaves, Hermes is reckoned the best surgeon for fractures." The most numerous and highly esteemed specialists were the ophthalmologists among whom many indeed had good right to the title, whilst others dealt only one-sidedly with the treatment of trachoma, with cataract operation, etc., or did a flourishing trade with all sorts of collyria and eye-lotions. Distinction between *medici ocularii* and *chirurgi ocularii* was general, although operative and medicinal treatment were sometimes united in the same person. Obstetrics, with the exception of particularly difficult cases, was relegated to midwives, whose knowledge, derived in part from the physicians, stood at a remarkably high level; it is hardly

¹ Galen, who in his own home practised both branches, says: "Since I lived in Rome I had to make many concessions to the customs of the capital, and leave most of these things to the so-called surgeons."

to be wondered at, however, that the midwives, in view of the trust reposed in them and the esteem in which they were held, extended the scope of their practice to the allied branches—gynæcology and pediatrics—even at times to the whole of medicine; the women-doctors (*medicæ, iarpivai*), of whom we hear, must, for the most part, have been of the guild of midwives. These various medical groups, which already suffered from a superfluity of members and included in their numbers many worthless or even disreputable elements, had to compete with astrologers, miracle-mongers, exorcists or quacks of the baser sort, the last of whom were mostly recruited from amongst the retailers of drugs.¹

The physicians of Rome belonged to many different social grades, a fact that could not fail to exert a considerable influence upon the average level of attainment and upon professional ethics. Not only that, amongst the numerous Greeks and Orientals who sought their portions as physicians in the capital, there were to be found adventurers of every sort, not only that people of little education, sometime artisans, discovering a supposed talent, exchanged their industry for the attractive trade of healing, but that a number of physicians also sprang from the slave caste (*servi medici* and *liberti medici*).²

Many of these, however, were by their whole education more suited to be medical assistants than responsible representatives of medicine. The associations, "*collegia medicorum*," which existed in the Imperial era amongst physicians as in other professions, appear to have wrought little for the elevation of their order.

The mischievous equality between genuine physician and quack was only gradually remedied through the granting of certain legal privileges and particularly the institution of public sanitary appointments, whereby an opportunity was afforded of putting the unworthy element in its place. The unpleasant situations which had doubtless arisen from time to time were distinctly reflected in the enactments of the later Imperial era. After the rights of citizenship had been granted to all physicians by Julius Cæsar and that complete immunity (freedom from taxation, from certain offices) had been attained by the concessions of Augustus, Trajan, Vespasian, but particularly by the favour of Hadrian, a considerable limitation of privileges followed under Antonius Pius. This emperor enacted that the full privileges of immunity should accrue only to a limited number of physicians, so that in each town, according to size, only five, seven, or at most ten should enjoy the privileges, with which also certain obligations were associated. In order to ensure true merit meeting with its reward Alexander Severus placed the right of conferring immunity in the hands of enfranchised citizens and landed proprietors and when, in his care for the education of physicians, he provided

¹ Collectors of roots, of herbs, dealers in salves (*unguentarii, myropolæ*), drug-vendors (*pharmacopolæ*), drug-dealers (*παντοπωλάι*), owners of medicine-booths (*seplasiarii*; the name originates from a street in Capua, where they were especially numerous), root-merchants (*aromatarii*), colourmen (*pigmentarii*). The pharmacopolists travelled about as quacks, and the keepers of booths utilised them to dispense pseudo-medical advice. From the distribution of cosmetics, abortifacients, poisons, etc., to universal quackery was only a step. The most notorious were the so-called "*medicæ*" and "*sagæ*," erstwhile prostitutes, who treated secret female disorders, procured abortion etc.

² Well-to-do Romans often owned several "*servi medici*," who at their masters' wish were medically trained and acted as slave-physicians or house-physicians: according to Cicero and Tacitus they were at times even made to serve criminal ends. Physicians, too, made use of slaves as assistants, and only the former were allowed to use them for purposes of gain. Since the interests of the *servi medici* and of their owners were frequently in opposition, when the question of liberation arose, this had to be regulated by law, and the *liberti medici* remained under legal obligation to their patrons, and could be compelled to accompany them, naturally a [serious] hindrance to the emancipated slaves in their own practice. There were also permanent *servi medici* in the service of the state and public freedmen (*liberti publici* or *municipales*). The position of the latter was very favourable; some of them enjoyed a most lucrative practice and left considerable fortunes.

funds for the free instruction of poor free-born youths, we may infer that under the term "medici" are to be included only those whose claim to the title had been earned by services rendered (usually in the department of public health). The institution of communal physicians, an ancient one among the Greeks, had also been adopted in the Roman Empire and, from the second century at least, most towns possessed salaried physicians who treated the poorer citizens gratuitously or for small fees. From the time of Valentinian II., who more firmly established the position of the communal physicians, these bore in legal enactments the appellation of "archiatri populares" in contradistinction to the court-physicians, the *archiatri palatini*. In addition to the town-physicians there were a number of others who occupied public positions, like the "medici ludi gladiatorii," whose duty it was to superintend the health and regimen of the gladiators, the "medici ludi bestiani" who were present at the beast-fights, and rendered aid to the wounded, physicians for the personnel of the "summum choragium" (i.e. those occupied with dramatic performances), of the public gardens, libraries, etc.

In addition, salaried physicians were appointed to most of the professional associations and colleges, whilst the vestal virgins also had their own doctors.

The army, too, from the time of Augustus onward was provided with surgeons for every branch of the service. The surgeons to the legions and to the prætorian cohorts had to be Roman citizens, whilst "liberti" or "peregrini" could be appointed to the "cohortæ vigiles" (police) and auxiliary troops; the army surgeons ranked as under officers. Wounded and sick soldiers were treated in tents and lazarettos (*valetudinaria*).

As regards the question of fees the greatest differences existed according to the reputation enjoyed by the physician and the social plane in which he practised. Whereas many physicians, whose work lay amongst the needy, remained all their lives poor, and the generality were forced to accept small remuneration on account of the great competition, we read of fortunate individuals who, as court-physicians, consultants or specialists, earned incredible sums. Thus the court-physicians Q. Stertinius and C. Stertinius Xenophon left 30,000,000 sesterces, and the legate Manilius Cornutus paid 200,000 sesterces for the treatment of a skin complaint.

Keen competition in conjunction with lack of responsibility in professional matters invited so great an amount of quackery that even the most reputable physicians, in their struggle for existence, were not entirely able to free themselves from it, and at that time every form of advertisement was to be seen, from the theatrical performance of operations before a number of spectators and the holding of public dissertations, down to extolling the virtues of remedies in the market-place (particularly of secret remedies),¹ even to inviting patients into the medical booths; the more ignorant the practitioner the more gaudily decorated his appliances (ivory caskets, silver cutting utensils and gold-handled knives) in order to dazzle the patient.

¹ The sale of medicaments by physicians themselves, a lucrative trade in many hands, exercised a most debasing influence upon professional ethics and to a certain extent degenerated into quackery. Remedies, often unnecessarily complicated and costly, suiting the ready credulity of the well-to-do classes, were kept in vessels upon which the name of the remedy and its discoverer, the ailment for which it was indicated and its method of use could be read; occasionally, even, the names of prominent patients who had been benefited by its use were added. High-sounding titles such as Ambrosia, Phosphorus, Isis, Anicetum carried with them a suggestive effect, and many physicians found in the discovery of all kinds of secret formulæ a source both of fame and income; abortifacients, antidotes and cosmetics found a particularly ready sale. Galen mentions a number of such inventors of remedies, amongst whom the physician Paccius Antiochus is frequently mentioned. He, as Scribonius Largus relates, possessed a "compositio mirifica" against pain in the chest, the manufacture of which he entrusted to no one; he compounded it behind closed doors and, to deceive his assistants, caused them to prepare more ingredients than were necessary. By means of recipes, expressed in symbolic characters, not only was the secret of preparation ensured, but an impulse was given to lucrative mysticism.

Dishonourable practices were rife, such as making much of trivial ailments, displaying uncalled-for zeal upon the first visit to the sick-bed, decrying all colleagues in order to throw the physician's own attainments into relief, and many lowered the status of their profession by disputes among themselves, by rude behaviour, slavish cringing or servile truckling to every mood of rich patients.

The decadence of the medical profession awoke the ridicule of the satirists and the contempt of the educated laity; even from their own midst arose loud complaints,¹ and although there is much exaggeration and over-ready generalisation, and although much may be excused upon the ground of the degeneracy of the age, the evil was nevertheless a deep-seated one and undermined the belief in legitimate practice whilst paving the way for popular medicine, as is evidenced in later times.

It is noteworthy that the decline of scientific medicine coincided with the epoch in which the interest of the laity in medicine reached its highest point and when participation in medical questions was found in all grades of society.

Varro held that knowledge of medicine was a necessary accompaniment of a complete education. Gellius says that it is a disgrace, not only for a physician, but for any individual man who had been well brought up, not to be familiar with those matters which concern the human body and the means which serve to maintain health. According to Plutarch every one should know his own pulse and recognise such things as are harmful or beneficial to him. Athenaios insisted that medicine should be made a subject of general instruction, since a knowledge of it was requisite in every calling, and every man should be his own physician.

The interest of the laity naturally found its chief expression in drug-mania. This gave the greatest impetus to charlatanry, for the physicians, courting the favour of the rich, only too readily threw Hippocratic principles by the board. Whilst pathology and diagnosis were ever more and more neglected, attention was concentrated upon the origin, the complexity and the attractive exhibition of remedies, and formularies took first place in medical literature. It was not its real therapeutic value that constituted the criterion of the position that a remedy should occupy in the pharmacopeia, but its foreign origin, its costliness, its rarity. In opposition to such a form of medical practice, which was adapted only to the luxurious rich, there naturally soon arose an endeavour to introduce simple, easily prepared household remedies, and in proportion to the growing distrust of official medicine, long-repressed folk-medicine attained more and more recognition, even amongst the upper classes.

Just as, at that time, the most heterogeneous religious beliefs of Græco-

¹ Scribonius Largus says:—"Many physicians are not only unacquainted with the ancient authors but even venture falsely to interpret them. . . . Each looks for what he may acquire without work, keeping notoriety and gain ever before him. Each thus practises as he thinks fit," Lashing the paltry greed of his colleagues in Rome Galen breaks out into the bitter words:—"Between robbers and physicians is this difference only, that the former's misdeeds are done in the mountains, the latter's in Rome."

Italian and oriental civilisation were fused into a whole, so also did folk-medicine grow into a syncretism of native and far more numerous eastern medical customs, which were widely disseminated by slaves, soldiers, artisans, merchants and quacks, and which were, for the most part, derived from primitive Babylonian and Egyptian priest-medicine.

This motley blend of folk-medicine first found literary expression in the "Natural History" of the elder Pliny, that relentless foe of the medical profession, who regarded the prevalent empiricism, imbued as it was with superstition, as a necessary supplement to the often inefficient "*medicina clinice*." This view he expressed with the greater confidence since the scientific art of healing in Rome had always remained somewhat alien, enigmatical and to a certain extent magical. It was, however, a momentous fact that even medical authors accorded to popular superstition an undue prominence in technical literature, and so gave it the stamp of their scientific authority. Thus Scribonius Largus in his formulary seriously recommended many fantastic popular remedies, and Archigenes advised, in certain cases, the use of amulets. The tares of medical mysticism, seemingly uprooted for ever by the liberal spirit of the Hippocratic age, shot up once more, and began to choke the healthy growth of enlightenment, since the empiric school, at its zenith in the Imperial era, welcomed without criticism any and every putative remedy.

The medical literature of later Rome, in particular, found scope for the little originality it possessed in recording the customs of popular medicine with a care well worthy of a better subject. It is the more satisfactory to note that even at the worst time there were not entirely wanting representatives of sober, scientific medicine, and, if their best endeavours seldom resulted in fresh achievements, but only in preservation of the ancient tradition, yet their attainments must not be too lightly esteemed, especially if one transfers one's self in thought to the environment in which the physicians of later antiquity were forced to work.

One characteristic of these surroundings was a decided leaning towards a magical and priestly medical art.

It would be a great mistake to suppose that rational medicine had ever completely ousted magical and priestly methods, although this impression is conveyed by the medical literature of Greece in her prime. The naïf empiricism of popular tradition, descending from distant ages, no less than medical thaumaturgy, could always reckon upon adherents, since true culture is never more than a thin veneer, the gulf between scholars and the vulgar being even greater in antiquity than now. Whilst, however, in ancient Hellas an Aristophanes did not hesitate to deride in public

speech the miracles of the Asclepiad temples, since only the lower classes clung whole-heartedly to superstition, in the age of the Diadochi the opposition of the cultured had appreciably weakened, to disappear completely during the Imperial era. Although at first the more strongly suggestive medical magic of the East predominated, the lapse of time gradually drove indigenous mysticism to the surface and brought into an undreamt-of repute the previously despised temple-magic of the Asclepiads, hitherto avoided by the upper classes. The yearning for salvation, constantly growing amid depressing general conditions, coupled with a strange leaning towards the miraculous, finally concentrated religious feeling in a special degree upon Asclepios, from whom deliverance was expected, not only from bodily, but from all other evils.

Superstition in medicine attained to enormous proportions in Imperial Rome, chiefly under the influence of oriental magicians, sorcerers, exorcists and priests, who fostered and spread the demonistic conception of disease already deeply rooted in the nation. Decrees directed against this evil in later times did not avail to check it.

The chief implements of magical therapeutics were spells, amulets, mystical procedures and cure by sympathy. Of charms, in addition to certain native formulæ hallowed by tradition, those were held in highest esteem that contained oriental words (Egyptian, Babylonian and Persian); a specially potent magical, exorcising power was ascribed to them. Amulets were fashioned out of vegetable or animal materials, out of stones (*e.g.* jasper, to promote fertility), or metals (in form of tablets, rings or nails), and were mostly worn round the neck or on one arm; a popular variety consisted in a scrap of parchment or a tablet upon which magic signs, spells or charms were inscribed. Magical procedures were undertaken upon the application of remedial measures, even in the act of digging up the plants used (recitation of magic words, invocation of demons, libations, incense). Pliny and the later Latin writings which drew inspiration from him, afford many examples of "sympathetical remedies." The strength of the belief in their efficacy, even among the educated, can be gathered from the "Lover of Lies" of the witty Lucian.

The cult of gods of medicine, too, awoke to new life. Asclepios, Isis and Serapis, indeed, were the most conspicuous, but almost every country, every province had a particular tutelary deity or wonder-working hero,¹ whilst, under the influence of the strongly setting tide of religious enthusiasm, certain chosen mortals were credited with miraculous healing powers.² Many new temples were erected to the gods of health, crowds of pilgrims betook themselves to their shrines, and dream-interpretation never enjoyed so great a reputation; particularly was this the case with the dream-oracles of Asclepios.

The most celebrated sanctuary of Asclepios in the Imperial era was that of Pergamos.

¹ In Rome Minerva Memor and Bona Dea were specially worshipped as divinities of healing; in Ephesus, Diana; in Seleucia, Apollo-Sarpedon; in North Africa, the "heavenly goddess" of Carthage; amongst health-givers were also reckoned the Dioscurides, the god Amen in Asia Minor etc. Amongst the wonder-working heroes were Toxaris and Aristomachos, Theagenes etc.

² *e.g.* the Neo-Pythagorean Apollonios of Tyana, who healed the blind and lame and raised the dead. Even Vespasian, much against his will, was included amongst the miracle-workers. Serapis had predicted to a blind and a lame man, in a temple-sleep, that the emperor would heal them in a miraculous manner during his sojourn in Alexandria, which actually came to pass. Vespasian caused the blind man to see by spitting on his eyes and eased the cripple of his disability by touching the impotent member with his heel.

The Asclepieia were the subjects of detailed descriptions on the part of eminent authors like Strabo and Pausanias. Although Cicero enunciated the dictum: "*medicina sublata, tollitur omnis auctoritas somniorum*," nevertheless all the achievements of scientific medicine were ascribed by preference to the votive tablets of the temples. As regards the methods of cure in the Asclepieia, in many cases the hygienic, dietetic or medicinal measures adopted, whether as a preliminary cure, or through dream inspiration, played no insignificant part (patients had, at times, medical directions, a prescription etc. in their hands on awakening). Even in those cases where temple mysticism in the form of the most absurd directions was concerned, the extreme sensitiveness of the public to suggestion led to a therapeutic result through the power of the imagination, and there is much evidence that the mental individuality of the patient was frequently taken into account. Quite prosaic-sounding medical directions or processes, the explanation of which was obvious, did not in the least shake the belief in a supernatural curative power, since, Asclepios being appealed to as the real healer, everything seemed divinely inspired. At any rate the patients, as Galen rightly observes, submitted themselves far more readily than if the same means had been employed by a physician outside the temple. Physicians and priests appear to have been on good terms; under certain conditions the former recommended their patients to appeal to the deity for direction in a dream, and at times carried out these directions. Such action would suggest policy on the physicians' part, an insight into the real state of affairs, but the statements made by so sceptical a thinker as Galen upon the miracles of Asclepios afford no support to such an assumption, since the physician of Pergamos relates in all good faith several putative miracles. If, however, as Galen held, or at least expressed, such opinions, it cannot be considered surprising that lay authors of this epoch should have accepted as authentic the most absurd fairy-tales from the Asclepios temples.

The success with which, under such circumstances, the credulity of the masses could be turned to account by cunning rogues is shown in the life-like description by Lucian of the adventurous career of Alexander of Abonuteichos (105-175), who gave himself out as a direct ambassador from Asclepios and, after many miraculous manifestations, established in his native town an oracle visited by countless believers. Here the deity spoke in person, through the mouth of a snake, and inquirers received their answers on sealed tablets. Surrounded by a staff of skilled accomplices, and in league with the neighbouring priesthood, this quack was able to keep up his deception for more than twenty years, not amongst the people only, but gaining adherents even in the highest and most intellectual circles, and up to the time of his death made a large income from his greatly-conceived undertaking. In particular this charlatan took advantage of the despondency which reigned at the time of the plague under Antonine; peripatetic emissaries fed the fear of coming events in order to be able to sell to advantage the amulets of Alexander, and over nearly every doorway might be read a doggerel verse sent out by him into all countries which ran: "*Phoebus, whose hair is unshorn, dispels the mists of disease*."

The malign presence of mysticism in medicine made itself most distinctly felt in those sad times in which devastating pestilences levied their toll, spreading terror and misery far and wide and defying alike all human precautions and every attempted medical interference. In the darkness of despair the will-o'-the-wisp of superstition is an irresistible attraction, and offers the only ray of hope.

The Roman Empire was visited in the period 170-270 A.D. by severe and lasting epidemics (plague of Antonine, plague of Cyprian), in addition to which unusual natural phenomena (floods, earthquakes, volcanic erup-

tions, comets) struck terror into the minds of a population already hard hit by wars and famine. Can it be wondered at if, in face of such immeasurable ills, salvation was looked for only from higher superhuman powers, if the art of medicine slipped almost wholly from the hands of the physicians to fall into those of exorcists, sorcerers and priests?

However important these external circumstances may have been, they yet demanded, in order to exert their full influence, a pre-existent and deeply rooted susceptibility to the supernatural in medicine, whilst the surprising credulity in cultured circles would remain incomprehensible if the key to the riddle were not to be found in the widespread and long-standing belief in the miraculous which permeated all classes, in the strongly marked revival of religion and in the mystical tendency of philosophy.

Superstition was notoriously inherent in the Roman character, and the Greeks, from their close contact with the East, became ever more and more entangled in its toils. Whilst in the classical age the aristocracy of intellect at least held itself aloof from these excrescences upon the popular religion and from eastern mysticism, a great change in Græco-Roman literature makes itself felt after the beginning of the first century. To our astonishment we realise that not only the dilettante world of fashion dabbled in scientific matters, but that even the most learned and intellectual Romans, albeit in a different degree, admitted a belief in romantic tales of wonder, marvels of nature, portents, dream-interpretations, prophecies, astrology, magical procedures and ghostly manifestations, and accorded belief and support to events the impossibility of which is at once obvious. Without laying too much stress upon the exaggerations of Lucian, it is only necessary to point out that, in the serious writings of a Pausanias, a Suetonius, a Cassius Dio, prodigies and spiritual manifestations are spoken of with full conviction, that the "Attic Nights" of Gellius, the "History of Animals" by Aelianus, the "Table-talk" of Plutarch, the Alexandrian collections of miracles teem with the most ridiculous fables related in all good faith by the authors.

Superstition is, however, a relative term, implying opposition to prevailing cosmological views. In our judgment upon the belief of ancient authors in the miraculous we must not make our comparisons in the light of modern conceptions of natural phenomena, which rest upon the assumption of an unalterable mechanical relationship between cause and effect. We must, on the contrary, take the fact into consideration that, to the inhabitant of the ancient world, there was no inherent improbability in the immediate interference of supernatural powers, and that he assumed the existence of universal, secret and unaccountable inter-

relationships between objects (doctrine of sympathy). What appears to us an unimaginable breach in the order of nature was, to the majority of the thinkers of antiquity, merely an unusual phenomenon. Thus it could come about that even a Pliny, standing aloof from popular creeds and identifying God with nature, relates events, to us the products of wildest superstition, without our being wholly justified in labelling the Roman, animated as he was by an unquestionable thirst for knowledge, as, in the spirit of the times, superstitious. The ancients may, however, be held blameworthy for a method of investigation into nature which, without further proof, simply accepted as fact the ostensible and unverified experience of common report. Since the prevalent criteria of truth were so deficient, continuance in the errors of folk-lore and mysticism was unavoidable.

Although individual branches of natural science were studied in the mathematical spirit, although mechanical principles were clearly formulated by prominent thinkers, yet the views held upon cosmic processes were only in the smallest degree based upon clearly-conceived mechanical ideas. This fact finds its best illustration in the explanation of whole series of natural events by the influence of sympathy or antipathy. The doctrine of *συμπάθεια τῶν ὅλων* grew out of observation of genuinely remote influences, such as that of the moon or the tides, or of mechanically inexplicable phenomena (e.g. attraction of iron by a magnet) and gradually assumed the position of a primary law of nature.

Sympathy and antipathy (inclination and divergence, love and hate, which are anthropomorphisms for attraction and repulsion, favourable and unfavourable influence) appear in ancient Hellenic natural philosophy as cosmic forces, implied if not explicit. The conception of "sympathy" meant to the Hippocratisists the inter-relationship of the body-parts, from which emanated the notion of the organism, i.e., of a body whose individual parts mutually influenced one another. It was this conception of the organism, with its inherent characteristic of interdependence of all its parts, to which the stoics gave adherence. The stoic system of metaphysics demanded establishment of the fact that the world was an organism; such proof could only follow, however, upon the demonstration of the interdependence, according to fixed rule, of various phenomena; upon the coincidence of certain processes. The known parallelism of certain cosmic and telluric phenomena (climate, season, vegetation) were indeed rational arguments which made cosmic sympathy probable, but, in order to adduce proof of the doctrine, far more comprehensive materials were necessary, which at this time could only be obtained at the expense of rationality, by the uncritical acceptance of ostensible observations.

The stoics took as their criterion of truth—to the detriment of pure science—the *κοινὰ ἔννοια*, the *consentiens hominum auctoritas*, whereby every "experience" is taken as proved if only common to a number of observers.

Recognition of such unverified observations not only served to substantiate the theoretical conception of the organic unity of the world, but the supposition of a mysterious, all-powerful natural force—"sympathy"—made it easy to realise the practical tendency of the stoic school: the artificial rationalisation of the irrational, as it were the scientific justification of popular belief in necromancy, in dream-interpretations, in miracles.

The stoics, at least in later times, understood by "sympathy" the natural inter-relationship of certain phenomena. Acting upon this principle, they and their successors more and more substituted incomprehensible phenomena, transcending human understanding, for

rational thought, whereby "sympathy" gradually became identical with a secret, inexplicable natural force, and the sympathetic merged into the magical.

The confusion in this conception of nature finds its expression in the fact that the word "physicum" in medicine gradually acquired the connotation of the sympathetic, the magical, in contradistinction to the scientifically explicable, whilst by the term *φυσικά* were understood not rational remedies, but, on the contrary, miraculous means.

Thus the transformation of the idea of sympathy brought it about that the whole inter-relationship of nature, the *συμπάθεια τῶν ὄλων*, was looked upon as magical, a conception which put an end to all investigation. This last link in an unsound chain of development represents the views of neo-Platonism, wherein the boundary between the natural and the magical entirely disappears.

The superstition of the later Græco-Roman world is the best gauge of the deep-seated religious movement which, at the close of the first century A.D., sprang into being and, deriving its stimulus from the East, finally paved the way for Christianity.

Many strange elements united to produce this great transcendental longing: a popular metaphysical sense, rooted in the remote past, a philosophic abstraction but imperfectly realised, individualism, dissatisfied with prevalent political and social conditions, finding an outlet in ethical aspirations and a thirst after mystical revelation.

As the medical literature of classic antiquity throws a veil over the co-existence of popular medicine, so do the writings of the last century B.C. and the first A.D. almost convey the impression that considerable sections of the public were permeated with religious indifference or even scepticism: the extant votive inscriptions, however, betray no dissolution of the ancient mythological beliefs. The religion of Latium, indeed, was little calculated to inspire any great degree of fervour, and Greek oracles were for a while in disfavour since Roman supremacy asserted itself in a preference for its own national cult. In intellectual circles pantheistic, monotheistic and even atheistic tendencies did indeed make themselves felt, which exceptionally, as with Lucretius, led to a downright hatred of the traditional gods. When rationalistic attempts failed in the justification of mythology by reason, recourse was had to policy. It is, on the other hand, undeniable that after the end of the first century of the Christian era, an incomparably more active religious movement made itself felt which not alone rejuvenated polytheism, but which assured it, even amongst the cultivated, an increasingly numerous and convinced following.

In the halcyon days of classic antiquity nation, government and religion united to form a homogeneous whole in which the individual gladly submerged himself.

The Roman universal monarchy, with its cosmopolitan and levelling consequences, led, on the other hand, to a divorce of politics and religion from a specific nationality. The subject races finding in the State no adequate compensation for their shattered individualities, the masses found in religion their chief stimulus, especially in the East. Thus as despotism hindered the development of individual energy, as the gloomy political and social conditions changed the ancient joy of life into sadness, and as moral loathing followed upon immoral license, so in like measure did a richer, if inharmonious, inner life develop, an ascetic longing after salvation through faith, for supernatural aid, a feverish striving after higher, occult spiritual comfort. Revolting from the Danaïd labour in which philosophic abstraction spent itself, a considerable portion of the educated threw their energies into religion, even into pietistic exaltation. Partly from genuine inclination, partly from political motives, the Imperial court—particularly after Trajan—aided and abetted the renaissance and reformation of the

cult which, under the influence of oriental example, became increasingly gorgeous. The lack of any fixed dogma imparted an immense expansiveness to Græco-Italian polytheism and allowed the tolerant inclusion of foreign gods and cults which, however, underwent a transformation in accordance with the Hellenic and Roman sense of beauty. So it came to pass that, through the international intercourse of the world-empire, Egyptian and Asiatic deities found a footing upon Western soil—priests, merchants, mercenaries all acting as missionaries—that worshippers of Isis and Osiris, of Baal, of Astarte, of Mithras were to be found both in the north and south. The incomprehensible ceremonies, the unusual symbols, the sensuous pomp of the oriental cults, but also their immutable moral laws, bound up with religious doctrines, all were in keeping with the exalted religious tendency of the age, which sought profound secrets behind all that was foreign and strange, and found complete satisfaction in expiation, mysteries, asceticism and ecstasy. Foreign creeds obtained great support when strangers, even orientals, ascended the Imperial throne. The newly risen creed of Christianity helped indirectly and for a time in the regeneration of polytheism, be it that the profound faith and self-sacrifice of its adherents provided a shining example of true religiousness, be it that it called forth an opposition amongst the heathen which manifested itself in the spiritualisation and ethical deepening of the old polytheistic belief.

With its yearning for supernatural enlightenment, with its deeply felt need of salvation, religious feeling increasingly permeated philosophic speculation, of which the intellectual pride and self-sufficing worldly wisdom were already undermined by a disintegrating scepticism.

Striving after ends little in harmony with its innermost nature, philosophy now sought, from the incongruous elements of deistic belief and the monotheistic prescience of the great Greek thinkers, to form an eclectic synthesis, a scientific religion, to create a satisfying doctrine for those seeking salvation. From sensualism and rationalism, through scepticism to mysticism—these are the mile-stones on the road traversed by the Greek intellect after centuries of strenuous endeavour leading to extinction in the fantasy of neo-Platonism. It was a death in beauty, but no less catastrophe could have led to the reversion from a wonderful, many-sided and profound intellectual development to the primitive emotions of a theosophical instinct.

The amalgamation of religious mysticism and philosophic speculation which took place in neo-Platonism is the last link in a long chain which was anchored in frank dualism, in the transcendental world of ideas of Plato. Amongst preparatory influences were the allegorical myth-interpretation, meeting vulgar belief half-way, the crude teleology and the ethical tendency of the stoic school;¹

¹ Whilst the doctrine of Epicurus excluded everything mythical and transcendental, the stoics paid the greatest homage to the metaphysical leanings of the popular consciousness and laid stress less upon scientific knowledge than upon ethical strivings; its ultimate development led the school to regard consolation as the purpose of philosophy (Epictetus, Marcus Aurelius). The philosopher became the soul's physician, its guardian. Nevertheless, although the stoics aided and abetted credulity by their recognition of magic, in the true ancient manner they made virtue dependent upon understanding, upon spontaneous reason, not upon supernatural favour.

amongst favourable ones, the limitations placed upon knowledge by the sceptics.¹

The Orphic-Pythagorean mysteries constituted the starting-point, the religious systems and occult doctrines of Egypt and Asia Minor furnished numerous contributions, whilst Platonism supplied the philosophic form.

Two tendencies stand out prominently, blends of religion and philosophy, which, imperfect and incomplete, made their appearance in the home of the most diverse forms of thought and belief—in Alexandria—at the commencement of our era: neo-Pythagoreanism, which united demonistic with monotheistic conceptions, raised the standard of worship and inclined towards asceticism and a belief in revelation,² and the Jewish-Alexandrian philosophy of religion culminating in Philo. Like its two offshoots, eclectic Platonism itself took on, in the first and second centuries, a religious colouring, as may distinctly be seen in early Christian apologetics.

Thus in the third century, through conflict with young Christianity, which found its first philosophic expression in the shape of Gnosticism, running parallel with it and paving the way for the Fathers, was evolved, as a final product, the neo-Platonic system. This, by means of its dynamic pantheism, of its doctrine of emanation, sought to bring about a purer knowledge of God, a reconciliation between faith and reason, offering to specially endowed natures, beyond what they could hope from rationalism, direct manifestation of the divine through gradual renunciation of the material, through ascetic purification and mystical surrender. Although Plotinus (204–270), the founder of neo-Platonism, considered his system to be rooted in science, and, in the hands of his pupil Porphyry, it was only a concession to traditional forms of belief, in the fourth and fifth centuries under the influence of Iamblichos and Proclus it became converted into a speculative theology which in true scholastic fashion defended the extravagances of religious mania and crass superstition.

Under the influence of transcendental mysticism, amidst the confusion

¹ Scepticism, from the relativity of knowledge, denied the possibility of recognition of the nature of things. Since antiquity did not content itself with observation of the orderly sequence of events in the world of phenomena, the sceptical attitude became the source of doubt of reason and science. It is thus easily comprehensible that many drew as a deduction that human thought required a complement in higher illumination, that truth was only to be attained through mystical speculation.

² Neo-Pythagoreanism combined the Pythagorean doctrine of numbers with the Platonic doctrine of ideas (ideas = numbers = archetypal manifestations of the divine spirit), united philosophic monotheism with popular polytheism, and set up as its highest ideal moral purification, renunciation of sensuality, elevation of the cult. The chief apostle of this tendency, Apollonios of Tyana, in Nero's time, travelled about, spreading abroad a purer conception of God, and supporting his doctrine with all kinds of miracles. He, in the fashion of the times, was held up as the protagonist of the ancient gods—in antagonism to Christ—and was endowed with supernatural attributes and powers.

of allegories, philosophy drifted into a conception of nature entirely magical, dissociated from all genuine investigation and scenting occult influences (sympathy—antipathy) in every event or phenomenon. Although speculation upon natural philosophy had at one time exerted a beneficial influence upon exact science, it now stood as a stumbling-block in the path of the latter and only served as a strong encouragement of occultism. The Græco-Roman world had indeed been flooded with the secret doctrines of Egypt and Babylonia, Persia and India, Syria and Judæa; these, however, first received pseudo-scientific support through neo-Platonism, which apparently rationalised the irrational. In Alexandria, the home of mysticism, the literature of astrology, alchemy, magic (including medical magic), and the different forms of divination (*e.g.* oneiromancy, cheiromancy) increased and multiplied. The enlightenment which, in her prime, had assured victory for Greece in the conflict against eastern mysticism, now failed her. The antique world, already sinking to decay, was incapable of shelling the husk from the sound kernel concealed in many of the occult sciences.

The literature of the Alexandrian secret arts united Egyptian and oriental traditions with Greek mysticism. The extant writings date, according to the time of their publication, mostly from the Roman Imperial era. In order to add to their reputation these occult fabrications were ascribed to the honoured sages of the East (*e.g.* Zoroaster) or of Greece (*e.g.* Orpheus, Democritus), older writings forming indeed the ground-work in many cases, since the ideas contained in them are mostly derived from earlier epochs. One whole group of theosophical-magical and astrological-alchemistic writings was derived from the mythical "Hermes Trismegistos"; many of these dating from the second or third century are in existence, partly in the original, partly in Latin or Arabic translations.

ASTROLOGY, which was an offshoot from the wisdom of the Mesopotamian and Egyptian priests, received a fresh impetus in the last centuries B.C. in Alexandria and was imported to Rome by "Chaldeans." In Alexandria there sprang up a voluminous apocryphal literature, ascribed by preference to Egyptian sources or to celebrated Greek philosophers. It was in vain that Cicero exhausted his stock of arguments in the attempt to stem the rising tide of belief in astral divination, in spite of great assistance on the part of the stoic philosophers. Astrological predictions dealt with general conditions or with the fate of the individual; the latter depended upon the position of the constellation at the moment of birth (horoscope, nativity). Astrology attained its highest practical importance under the Roman Emperors, the majority of whom were themselves believers in astral revelations and who, in their acts of government, were largely influenced by the court astrologers. Nevertheless there is no inconsistency in the fact that, in spite of widespread and intense superstition, the "Chaldeans" were repeatedly banished from Rome by order of the Senate or by Imperial edict; this was due to their frequent and dangerous machinations, and occasional persecution only strengthened the delusion. The few who derided this sham science and combated it (Horace, Pliny, Juvenal) could make no impression upon a prejudice which had permeated every grade of society. As previously the stoics so, in the decline of classic antiquity, the neo-Platonists sought a philosophic foundation and, although the Church naturally held aloof, yet certain Christian sects, as *e.g.* the Priscillianists, united their theological speculations with astrology—a proof of the esteem in which this was held.

Astrology was the most important part of the "Naturalis theologia"; its influence made itself felt in every branch of natural science, and just as there were developed an astrozoology, an astrobotany, an astromineralogy, so there grew a tendency once more to bring medical prognosis and therapeutics into touch with astrology (collection of plants under their planetary sign, consulting the stars in the administration of drugs etc.). Prognosis was determined by the use of more or less complicated tables of numbers, e.g. the κύκλοι of Petosiris, the σφαῖρα Δημοκρίτου of Hermes Trismegistos wherein, in the prediction of the outcome of the disease, the number value of the letters of the patient's name is taken into account. The keenest opponent of medical astrology was Sextus Empiricus, who inveighed against this dangerous tendency in the fifth book of his work *πρὸς μαθηματικούς*. Galen, in contrast with Hippocrates, had a leaning towards astrological doctrines, and the prominent position which astrology later occupied in medicine was in no small degree due to his authority.

The earliest traces of ALCHEMY may be found in Egypt, the land where, on the one hand the occult sciences were indigenous, and where on the other metallurgy early attained to a considerable development. The notion of the possibility of transmuting base substances into precious (gold, silver, jewels) arose in the first instance from wrongly interpreted experience, the alchemistic doctrine being only a secondary addition. Thus, for instance, the observation was made that the colour of copper changed by appropriate treatment (with substances containing zinc) into a golden yellow and (with others containing arsenic) into a silver white; that lead ores (not known to contain silver) leave a small residue of silver on heating; that, in the manufacture of glass, substances resembling precious stones are produced, and so on. Such results being obtained by chance, and the nature of the process not being clearly understood, whilst the substances formed resembled precious metals or stones, if imperfectly, the belief arose in the possibility of ennobling metals, i.e., of manufacturing gold or silver. The Egyptian priests recorded their observations in their secret volumes, wherein the origin of alchemy was attributed to Thoth, i.e., Hermes Trismegistos; the occurrence of mysterious phenomena being attributed to the interference of demoniac powers and later to the influence of the planets upon certain metals; it is on this account that in the oldest alchemistic works magical spells accompany chemical formulæ and each metal is designated with one of the signs of the Zodiac. Since colouration was originally looked upon as the most important end in the process, the oldest alchemistic writings deal with the "colouring" of the metals and stones. The Greeks accepted as an established fact the practice of alchemy which they found rooted in Egyptian soil, but sought rational explanations untinted by demonism. Such practice seemed to them fundamentally only to substantiate the idea already enunciated by the nature-philosophers, viz., the transmutability of the elements.

Aristotle, with his conception of energy in nature, with his constant indication of the transition from potential to actual, had so enlarged the traditional ideas of the nature-philosophers that they could be made use of by the Greek alchemists as the guiding principles of their doctrines.

In the midst of the overgrowth of occultism medical thaumaturgy found a favourable soil, its theoretical presupposition, demonism, constituting an integral part of current cosmology. Not only did the belief in demons, ineradicably fixed in the popular mind, gradually penetrate into all grades of society; not only did the adherents of every religion subscribe to and foster it, but philosophy itself ratified it and elaborated demonology into a complete system, seeing therein the means to hand of bringing belief in the gods and religious worship into harmony with the requirements

of reason. Mythological fables incompatible with the gradually matured philosophical conception of a divine power, the contradictory religious observances of different nations, all seemed justified when popular divinities were identified with demons; motley polytheism was admissible, without prejudice to monotheism, if an intermediate realm were recognised, super-human but sub-divine, which, as an emanation from the universal consciousness, formed the connecting link between man and the deity fashioned by the thinkers and enthroned out of reach of all sentient faculties.

Demonology, with its specious credibility, hardly to be realised at the present day, made its influence felt in conceptions upon disease, appearing with startling distinctness in clinical descriptions. As spiritual emotions are frequently reflected in illusions, so, at many times or in many places, cases of "possession" assume epidemic form. Herein lay the opportunity for theurgical and magical medicine to expel the evil spirit by exorcism; herein heathen, Jewish and Christian miracle-mongers were in active competition, it might even be said that the duel between polytheism and Christianity was fought upon this issue.

If it be granted that the decline of medicine was the sequel to long existing intrinsic deficiencies, that its decay in the last centuries of antiquity was rendered inevitable by general cultural conditions, then the influence of Christianity upon this era is by no means of that far-reaching, decisive importance in an unfavourable sense, that is frequently supposed. For the same holds true here as elsewhere: Christianity in its triumphal progress encountered and overcame an antique world no longer brilliant, harmonious, conscious of its power, but a race broken by every kind of misfortune, dismembered, permeated by doubt and despair; its downfall being merely hastened through the strong support lent by Christianity to those spiritual tendencies which, whilst running counter to the original disposition of antiquity, yet had their source in decadent Hellenism. The intense longing for salvation and atonement which thrilled mankind and which sought its sublimest expression in neo-Platonism; the close association of ethico-religious aspirations with medical thought and action, as shown in fervent worship of Asclepios, the saviour in bodily or spiritual need had, even in heathen times, considerably lowered the estimation in which scientific medicine was held, and awakened medical theurgy to new life. Christianity, claiming a monopoly of spiritual guidance, displayed a similar proclivity, complementary, subversive and more far-reaching in its results, with greater self-assurance in its methods. In the beginning, distrustful of scientific medicine, which appeared indissolubly bound up with paganism, Christianity rejected "worldly" remedies and, in addition

to nursing, admitted the use only of means of healing sanctioned by the Church, prayer, laying on of hands and exorcism.

Jesus worked amongst his people as the physician of soul and body; the New Testament makes mention of many diseases miraculously cured by divine influence through the medium of Jesus or his disciples. The Gospel is addressed to suffering mankind in the widest sense and its vivid language contains many medical similes, the care of the sick being enjoined as one of the most sacred duties of Christianity. The nature of the treatment extended to sick Christians is evident from the Epistle of St. James, where it is said :—"Is any sick among you? Let him call for the elders of the Church; and let them pray over him, anointing him with oil in the name of the Lord; and the prayer of faith shall save the sick and the Lord shall raise him up . . . pray for one another that ye may be healed. The effectual fervent prayer of a righteous man availeth much."

As Christianity spread throughout the world it encountered, both at home and abroad, a number of coincident popular views and customs conceived in the spirit of demonology and, despite opposition, many heathen superstitions crept in and established themselves. There was then often no alternative except to impart a Christian colouring to the ancient form of paganism. Christianity looked at first with considerable misgiving upon medical science, since it appeared not seldom bound up in practice with pagan mysticism or ethical shortcomings, and ascetic enthusiasts promulgated the view that the employment of drugs implied want of faith.

As, however, the Church gradually applied ancient and natural philosophy to its own purposes, so also did the prejudice against scientific medicine disappear, and the student of patristic literature realises with astonishment the thorough acquaintance of many of the Fathers with medical works and with the nature of medicine, frequently dissenting as they did, with critical insight, from the visionary speculations upon natural philosophy of the neo-Platonists.¹

That the views of the Fathers upon natural science and medicine should have been in support of teleology and dogmatism, and should have been of a practical and didactic nature, is only in keeping with the character of their works, and it would be idle to seek, in this period of universal stagnation, any incitement to free, impartial investigation amongst those who considered their whole duty to consist in the establishment of the belief in revelation.

Although there can be no doubt that Christian dogmatism, having once established its sway, proved the most serious drag upon inquiry—nevertheless the abundant charity of early Christianity had sown a seed whose fruit was to be of the greatest advantage to medicine. The loftiest conception of medical ethics in antiquity, as represented by the Hippo-

¹ The Fathers waged war against abortion, sexual excess and perversities. In hygienic matters they were often constrained to an opposition of luxury and vice—in such matters as excessive bathing—which reacted unfavourably upon the general care of the body. Early Christianity is also hardly to be congratulated upon having entirely broken with the hygienic prescriptions of the Mosaic religion.

cratic ideal, enjoined upon the physician the refusal of his aid to the incurable ; the humanitarian views of Christianity with their high appreciation of human life made it his moral duty to lend his aid even in these cases. The fact that such a moral duty should, in time, lead to a renewed impulse towards investigation lies inherent in human nature.

Though for the time science was unable to profit to the full by this experience, active philanthropy endeavoured to allay suffering by means of self-sacrificing care of the sick, by establishment of hospitals—in which institutions, in the distant future, true clinical science was to arise. The best thoughts, embracing the welfare of mankind at large, ever spring from the heart.

The self-sacrifice displayed by the Christians at the time of the great plague in the third century is borne witness to by Dionysios of Alexandria. "Most of our brethren spared not themselves . . . and held one to another. Fearlessly they visited the sick . . . with the heathen it was quite otherwise. They spurned those who fell ill, fled from their nearest and dearest, cast the dying into the streets and left the dead unburied." Tertullian often heard in unfriendly mouths, "See how they love one another."

The early Christians coupled with the care of the poor attendance on the sick as an abiding duty devolving upon the congregation ; freewill offerings were collected at the Sunday services for these objects. As the Church attained recognition by the state and substantial means, the care of the sick was carried out upon a large scale by the education of its own attendants and the foundation of public hospitals. The oldest was the "Basilias" founded by St. Basil in Cæsarea, A.D. 370. The foundation of the oldest infirmary in Rome is ascribed to Fabiola (ca. 400), whilst hospitals were established in Jerusalem by the Empress Eudocia, A.D. 420.

Antique culture still remained almost exclusively the care and charge of adherents to the old mythological beliefs. And as decadent heathendom lost ground after the conversion of Constantine, so did it cling with the strength of despair to its priceless heirloom, Hellenic science. Whereas in newly founded Byzantium courtly and Christian influences began to predominate, philosophy in the schools of Athens took on a new lease of life, and Greek investigation and speculation flourished untrammelled in Alexandria. Here neo-Platonists and learned expositors of Aristotle held aloft the banner of enlightenment against the advancing phalanx of benighted Christian zealots ; here laboured quietly, hoping for better times, men like Diophantos, Pappos and Theon, whose admirable achievements in the domain of exact science are reminiscent of the glamour of the past. For this reason the abortive attempt at apostacy on the part of the Emperor Julian manifested itself especially in a renaissance of ancient Greek culture, with which paganism had a thousand links ; thus it was, also, that Christian fanaticism became directed against the philosophers and in particular against the citadel of Hellenism, the Alexandrian library, which eventually suffered great damage at the hands of a Christian mob.

In a retrospect of heathen antiquity medicine plays by no means the least important part. As yet its scientific elaboration and nurture lay mostly in the hands of pagan physicians, particularly of those of the Alexandrian school, where iatrosophism flourished and the richest literary treasures were amassed. In that senile age medical research consisted indeed far less in the communication of previously unknown facts—though excellent individual observations in many branches were by no means lacking—than in collection, critical examination and interpretation of transmitted knowledge. The great decline in the level of professional attainment which had taken place since the third century necessitated extracts, more or less inadequate and abridged, which took the place of the voluminous originals, laborious study of which was beyond the majority.

With the lapse of time more and more tribute was paid to the memory of the great Galen; unappreciated by his contemporaries, a petty generation now looked up with awe rather than understanding to the titanic labours of this genius, which increasingly appeared to them an inimitable example. It is a tribute to the far-sightedness of the Emperor Julian that, in his plan of reform, he attached considerable importance to ancient medicine, and therefore commissioned his court-physician, Oreibasios, to draw up, from the medical classics, a comprehensive encyclopædia, the foundation of which was to be laid upon excerpts from the writings of Galen. This work was the means of saving much from the general wreck.

Oreibasios followed closely in the footsteps of Galen. The compiler Cælius Aurelianus selected as the highest achievement of antique medicine the doctrines of the methodic school, which from their practical simplicity could always count upon many adherents in the West, and sought to introduce them in Latin to Western Rome. The after-effect of this endured for centuries, and was in the domain of medicine an expression of the deeply marked historical separation between the Hellenic—and never Romanised—East and the West, which had its outward and visible sign in the division of the Roman world-empire.

In the Byzantine East ancient tradition, and with it ancient medicine, was uninterruptedly maintained, if only in a mummy-like form. Quite otherwise did the art fare in the West. When proud Rome succumbed to the onslaught of the northern barbarians, medicine was compelled, in the stress of the times, to find asylum in the monastic cell. Upon this long hibernation followed after a thousand years a renaissance such as the Old World had not been able to bring about. For truly all death is a passing into life.

THE LITERATURE

THE medical literature which has come down to us from the period comprised between the commencement of the third and the end of the fifth centuries betokens the stagnation or even decay of the ancient art of healing. Independent observations, new ideas or practical advances are rare oases in this intellectual wilderness, industrious compilation is reckoned an achievement of the highest merit. Greek writings preserve throughout something at least of a scientific character, those of Latin origin, on the other hand, are in part the work of the laity, with whom popular medical superstition and crude empiricism found adherence. The Roman world the more readily gave acceptance and wide publication to compositions of this nature since there was in it no active interest in theoretical discussion; it must be borne in mind, however, that only in much later times were these pseudo-scientific writings accorded their most undeserved position in technical literature.

The most meagre literary bequest is that of the third century—in keeping with the melancholy conditions universally obtaining and with the degraded state of science in general. It consists of the didactic poem of Quintus Serenus Samonicus, “*De medicina praecepta saluberrima*,” and of the “*Medicina ex clericis et pomis*” of Gargilius Martialis. Both writings are largely based upon Pliny and may practically be regarded as popular formularies: the former in particular is permeated with superstition.

There were two learned writers named Quintus Serenus Samonicus, father and son, the former of whom was put to death by Caracalla, A.D. 211, ostensibly for the use of magic. The question as to whether the didactic poem, “*De medicina praecepta saluberrima*,” in 1115 hexameters, is to be ascribed to the elder or younger Samonicus remains unsettled, despite much laborious research. The subject matter is largely derived from Pliny and Dioscorides, its presentation being characterised by a dilettantism devoid of critical insight. It consists chiefly of a formulary for the poor and is divided into 65 chapters, the first 42 containing recipes against various disorders arranged a capite ad calcem, the remainder remedies against injuries, fever, fractures, dislocations, insomnia, lethargy, epilepsy, jaundice, poisoning, warts and haemorrhoids. In addition to useful, or at least harmless, remedies many others of a disgusting nature are recommended (*e.g.* pigeons’ droppings; excrement of mice as a compress in inflammation of the breast; bed-bugs in epistaxis; goats’ urine in vesical calculus

and intermittent fever). It is amusing to note that the author, in the cure of intermittent fever, first discredits the value of charms,

“Nam febrem vario depelli carmine posse
Vana superstitio credit tremulæque parentes,”

but immediately afterwards advises the employment of amulets, mentioning the well-known “Abracadabra,” which was to be written down repeatedly, dropping a letter at a time, forming a conical figure as under—

A B R A C A D A B R A
A B R A C A D A B R
A B R A C A D A B
A B R A C A D A
A B R A C A D
A B R A C A
A B R A C
A B R A
A B R
A B
A

The etymology of this incantation is variously explained, *e.g.* from the Hebrew words *ab*, *ruach*, *dabar* (Father, Son, Word), or *abra*, *cad*, *abra*, *i.e.*, the fever is past, etc. Against epilepsy, Serenus Samonicus recommends the use of the fabulous stone from a swallow's nest, and, in order to assist the teething of children, horses' teeth should be hung round them.

The “*Medicina ex clericis et pomis*” of Gargilius Martialis originally formed but a part of his great work upon agriculture. The writing which, in the Middle Ages, enjoyed great popularity and was frequently annotated and epitomised, dealt with the dietetic properties and therapeutic uses of more than 60 plants; the contents are mainly derived from Pliny, but in addition Dioscurides, Galen and others are represented.

Fragments of the works of Philumenos may be considered as remnants of the scientific (Greek) literature of the third century, provided that the results of later investigations, which place the time of this author's life at about 250 A.D., are substantiated.

Philumenos belonged to the methodic school, but in practice, as extracts from his writings show, he took up an eclectic attitude, making great use of the labours of his predecessors, particularly Archigenes, Soranos and Herodotos. The compilations of Philumenos, which served as a welcome model to later compilers, and to a certain extent replaced study of the originals, covered the entire ground of therapeutics. Extracts, still extant in Latin translations, dealing with abdominal affections, as well as fragments upon obstetrics and gynaecology, are specially noteworthy. In the former, Philumenos shows himself as an exceedingly rational practitioner in the treatment of intestinal affections, and one who energetically combated the misconception which led to every case of diarrhœa being treated in routine fashion with astringents; diarrhœa occurring with “*rheumatismus ventris*” and “*passio cœliaca*” he treated with warm milk, slightly astringent food and opium preparations, tenesmus with astringent suppositories, local application of moist compresses, inunction with oil and demulcent decoctions. The gynaecological fragments deal with tumours of the uterus, metritis, mastitis: of even greater merit are the dissertations upon anomalies of delivery (pelvic contraction the most important hindrance, gradual dilatation of the contracted os with the fingers, use of enema and catheter, incision of the persistent hymen, rupture of membranes,

etc.), version, embryotomy, embryulcia, removal of retained placenta, indications for and performance of artificial abortion.

A far more pleasing picture is presented by the fourth century, both as regards quantity and quality of literary output. Traces are met with of the once famous school of Alexandria which, true to its mission, even at this period of eclipse, held aloft the torch of medical progress.

The most prominent figure of the Alexandrian school in the first half of the fourth century was Zeno of Cyprus, who acquired great fame as physician and teacher. The most notable of his pupils were Ionico of Sardis, Magnos of Antioch, more sophist than practitioner, and Oreibasios.

The school of Alexandria produced one admirable physician, who caught a reflection from the setting sun of antiquity and who, full of reverence for the greatness of the far-distant past, drew what was best from the medical works of his predecessors and by intelligent classification united the extracts into a coherent whole. This was the body-physician of Julian the Apostate, Oreibasios.

Oreibasios, the scion of a noble house, was born about 325 A.D. at Pergamos and studied as a physician in Alexandria under Zeno of Cyprus. He rapidly acquired fame and, probably upon the recommendation of Zeno, became court-physician to Julian. Intellectual sympathy bound the two closely together, Oreibasios frequently assuming the rôle of political adviser, Julian evincing the keenest interest in the studies of his physician, whom he held in the highest esteem on account of his attainments. Encouraged by the success of a volume of extracts from Galen, Oreibasios conceived the plan of collecting all that was best from other authors in an encyclopædia on a large scale. Already loaded with honours, Oreibasios, after the accession of Julian, was named quæstor of Constantinople, where he continued, not only his literary and medical but also his political career. He accompanied the Emperor on his campaign against the Persians and attended him faithfully until his death from a wound.

A shadow now fell over the life of Oreibasios. The new rulers Valens and Valentianus deposed him from his office and, as punishment for his influence upon the anti-Christian rule of their predecessor, delivered him over to "the most savage of the barbarous races"—probably the Goths. However, on account of his professional skill, he rose to high esteem amongst the barbarians, and the Emperors were soon constrained to recall him and to reinstate him in his former position. He lived to an advanced age in Byzantium, an indefatigable physician and author, his death occurring at the commencement of the fifth century.

Although Oreibasios neither enriched medicine with epoch-making ideas nor added to it any great clinical observations, and although his writings essentially consist of diligent compilations, nevertheless, considering the circumstances prevailing in his day, he assumes a position of special eminence. He cleared for the practitioner the path of rational medicine which had, to a great extent, been overgrown with empiricism and mysticism and dissipated the ever-growing confusion by demonstration of the scientific method. This merit may easily be overlooked if the peculiar conditions of his age are not taken into account. It cannot, however, be denied

that, in the evolution of medicine, the literary and historical importance of Oreibasios outweighs the practical. It was his successors rather than his contemporaries who owed a debt of gratitude to Julian's body-physician, in that he recorded numerous fragments from lost medical writings of classic antiquity.

Oreibasios it was, in fact, who first smoothed the path of the great Galen. By a careful exposition of the latter's doctrines he made them widely known amongst physicians who would otherwise have been repelled by the prolixity of writings by no means adapted for superficial reading, and he accustomed them to recognise Galen as the supreme authority upon most medical problems, whilst giving due recognition to the opinions of other schools (even of the methodists). Oreibasios, seeing in Galen the highest development of the Hippocratic art and of medical science, based even the plan of his Collection upon him, and in his great encyclopædia, *Ἱατρικαὶ Συναγωγαί*, he accorded him the most prominent position, whereby the foundations were laid for the millennial dominion of Galen in medicine.

The *Ἱατρικαὶ Συναγωγαί* consisted of more than 70 volumes dealing with general dietetics, general therapeutics, materia medica, physiology and anatomy, hygiene, nursing, diagnosis, prognosis, specialised pathology and therapeutics, and surgery.

Unfortunately a considerable portion of this greatly-planned encyclopædia has been lost, but what remains affords us a surprising insight into the wonderful richness of ancient medicine; the surgical sections—the most complete technical treatise of antiquity—allow a reconstruction of the astonishingly developed surgical technique of the Roman-Alexandrian epoch.

Oreibasios took the entire literature of the past as his foundation—he may in parts have utilised already existing compilations—and usually made excerpts of the most important passages from older medical authors, indicating their origin. Whatever might be the historical and literary value of this procedure, the unity of the work, the organic structure of the whole was bound to suffer in those cases in which the authors quoted mutually contradicted one another. There can be no doubt that Oreibasios possessed a wide practical experience, which comes into evidence in many additions, particularly to the chapters upon diet and hygiene, and upon general therapeutics: on the whole, however, he is deterred from putting his own ideas prominently into the foreground by his inordinate reverence for his predecessors, and his modesty rarely permits him, in debatable questions of wide range, to throw his own judgment into the scale. Thoughtfully conservative in his instincts he clung to authority, doing no more than improve many details quietly and unostentatiously, betraying his

individuality only in the choice and arrangement of his materials, in paraphrastic discussions, animated solely by the endeavour to make the treasures of literature easily accessible to the physician in an attractive and convenient compilation.

Nevertheless the deeply read and erudite Oreibasios seems to have overestimated the receptive power of the practitioner: the *Συναγωγαί* does indeed present the matter in convenient arrangement, but its immense volume still acted as a deterrent to its use, especially to the beginner. For this reason Oreibasios who, in following the medical studies of his son, had come to realise the necessity for a short text-book, determined in his old age (not before 390 A.D.) to undertake an epitome of his great work. This is extant in the shape of the nine books of the *Σύνοψις* (*πρὸς Ευστάθιον τὸν ἰδὸν αὐτοῦ*), which purposely contained only the essentials of the art of healing and conveyed in concise form the mature experience and independently acquired judgment of the author. It is noteworthy that surgery is not taken into account, being considered a subject only for specialists. The attractive accounts of gymnastics, diet at various ages, education and diseases of children are of especial interest.

One thing must be placed to the credit of Oreibasios, viz. that, in this age, where mysticism of every kind abounded, he withstood the temptation to include in his works the widely prevalent methods of superstition. Greater physicians before and after him were less circumspect. In order to disseminate among those of the laity who were friendly to the medical profession, the *φιλήατροι*, sound views from truly scientific sources, in order to exercise an enlightening effect and to check the pernicious influence of the quacks, he wrote, about 392–395 A.D., the treatise *Εὐπόριστα*, conceived upon popular lines, whose four volumes treated of dietetics, hygiene and *materia medica* in general, but laid stress upon special therapeutics of individual diseases. The esteem in which the Synopsis and Euporista were held is proved by the early date of their Latin translations: by means of these two books Oreibasios' influence extended far beyond the sphere of his own life-work.

Of the 70 books of the *ιατρικαὶ συναγωγαί* (*Collecta Medicinalia*) only about a third are in existence, the following being the subjects dealt with: food, drink, gymnastics and dietetics, blood-letting and other derivative measures, climatology and hygiene, external remedies, baths, simple and compound medicaments, general physiology and pathology, symptomatology, embryology, anatomy, inflammation, tumours, general surgery, fractures and dislocations, bandaging, apparatus and instruments, diseases of urinary and sexual organs, hernia and ulcers. Many important sections dealing with internal medicine are lost. In many places the independent experience of the author is revealed, *e.g.*, in the teaching upon venesection (which was not to be undertaken as a matter of routine upon certain days, but only with regard to the

severity of the disease and the state of the body; in inflammation, upon the affected side), in his doctrines upon diet, gymnastics, massage, in his extensive use of enemata (which he also used in bladder affections), etc. On the whole, however, his own ideas and achievements are only too much relegated to the background; in contentious matters he even hesitates to express a decided opinion and adduces instead extracts from other authors upon the same subject. Leprosy, for instance, is three times dealt with, following Galen, Ruphos and Soranos. In the anatomical sections this want of independence makes itself particularly felt, for in this subject Oreibasios lacked even so much experience as was necessary for criticism, *e.g.*, he describes the uterus twice, once after Galen, a second time after Soranos, because they varied in their description, and even in such rare cases as when he was in a position to amplify or correct the assertions of Galenical anatomy, he held his hand from exaggerated reverence for the attainments of the great Pergamene, whom, with Soranos and Lycos, he followed exclusively. In one place, discussing venesection, he reports that, in dissection of apes, he discovered nerves beneath and close to the median vein of the forearm; nevertheless he nowhere mentions this discovery in his anatomy, much less does he make it a starting-point for further investigations into the nerves of the arm. The *λατρικαὶ συναγωγαὶ* constitute with the works of Galen and the Byzantine authors a chief source of our knowledge concerning the medicine of antiquity. Without Oreibasios we should not so much as know the names of many authors.

To supplement the descriptions given earlier one or two fragments from the surgical books of Oreibasios may be included, quoting Archigenes, Heliodoros and Antyllos, these extracts being of importance in the surgical history of the Roman Imperial era.

ARCHIGENES. Oreibasios, xlvii. 13, on circular amputation: "The vessels leading to the seat of amputation are to be tied round or to be sewn, or, as is often done, the entire limb is to be surrounded with a bandage; cold is also to be applied, whilst some let blood . . . removal through the joint is to be avoided. The skin is to be drawn up with a bandage or other object exerting circular pressure, near which bandage circular incision may take place. The amputation knife should be in proportion to the size of the member to be taken off. The limb to be amputated must be placed in such a position that the instrument with which the encircling incision is to be made and the sawing performed can do its work unhindered. After section the sinews around are to be removed and the integuments being pushed back, the bones are to be sawn through. If any considerable bleeding occurs, cauterising must be done with a hot iron of sufficient thickness."

HELIODOROS. Oreibasios, xlv. 14, on amputation: "The hand or foot is taken off if gangrene be present or if the extremity of a limb has died from any cause. . . . Some strive after needless rapidity, severing all the soft parts at one stroke, and then sawing through the bone; such an amputation, however, is not without danger, because many vessels bleed simultaneously; therefore I hold it better to incise the less fleshy parts of the limb first, *e.g.*, on the tibia, then to saw and, after sawing the bones, to divide the remaining soft parts until the entire limb is removed. I am accustomed first to surround the site of amputation with a bandage in order, so far as possible, to bring about a closure of the vessels, then to proceed as described. In sawing, the blade of the saw must be applied evenly so that the sawn surface of the bone may be smooth. After sawing the bone the soft parts still remaining attached are divided, and immediately after removal large pads of lint are applied, outside of which sponges, held in place by a moderately firm bandage."

I. 9, on treatment of stricture of the urethra, which was considered to arise as a result of fleshy overgrowth. Division was effected by means of a narrow stiletto, a bougie of dry paper being then inserted, which contained in its centre a small metal tube or a quill.

xlvi. 29, upon bandaging (roller bandages, split bandages), *ibid.* 33 *et seq.*, many ingenious forms of bandage.

ANTYLLOS. Oreibasios, vii. 7-11, technique of venesection, *ibid.* 14, arteriotomy, *ibid.* 21,

bdellotomy, xlv. 8, surgical treatment of abscesses, *ibid.* 22, 23, upon fistulæ (examination with probes, bougies fashioned out of papyrus for dilating, methods of operation), xlv. 24, aneurysms, *ibid.* 25, 26, colobomata (of eyelids, forehead, cheeks, nose, ears), l. 5, *et seq.*, operations for phimosis and circumcision.

SYNOPSIS. Extracts of especial interest in this are: upon dietary of pregnant women (v. 1), choice of nurses (v. 2), pediatrics (v. 5-13), education of children (v. 14, commencement of instruction at 6-7 under friendly teachers, with whom children learn gladly, tranquillity of mind greatly tends to bodily well-being, ἡ δὲ ἀνεσις τῶν ψυχῶν εἰς εὐτροφίαν σώματος μεγάλη συμβάλλεται, abstinence from wine), doctrine of temperaments (v. 43-53, chap. 45 contains a short phrenology). It is noteworthy that Oreibasios in feverish exanthemata rejected the use of diaphoretics, and recommended instead mild aperients, treated asthma with diuretic drugs, diabetes with diaphoretics and looked upon hæmorrhoids as a constitutional disease.

In the Synopsis are found directions upon medical metrology, as well as prescriptions against different external ailments, which originate from the iatrosophist Adamantios, a contemporary of Oreibasios: it would appear that Adamantios devoted himself particularly to dentistry (the chief part was played by measures against toothache, *e.g.*, decoction of mallows, hyoscyamus-juice, extraction being at that time little practised).

The Εἰσόριστα are dedicated to the learned Eunapios and intended for the educated lay public. They serve the purpose of imparting a certain degree of medical education to the latter so that they may act rationally in case of necessity in minor ailments, sudden emergencies in travelling, or in the country when no physician is at hand. In the preface attention is drawn to the common danger incurred through quacks (amongst whom, as always, were those who professed to have been erstwhile medical assistants), and emphasis is laid upon the fact that the proper performance of medical duties calls primarily for a knowledge only to be acquired through a special theoretical and practical education.

The power of accurate observation possessed by individual Greek physicians even in the decline of antiquity is shown in the fragmentary works of Philagrios and Poseidonios (the two sons of the physician Philostorgios). In addition to many other independent achievements the former earned an enduring fame through his work upon the subject of diseases of the spleen, the latter upon that of psychoses. The name of Poseidonios, who—a rare exception—combated the demoniacal origin of certain mental diseases, is bound up with an early attempt to localise the cerebral functions.

Philagrios was a native of Epirus and practised in the second half of the fourth century in Thessalonica; he was the author of numerous writings, of which we are familiar only with isolated fragments. Humoral pathology underlies his conceptions of disease; in therapeutics (tolerably free from mysticism) stress is laid upon dietetic prescriptions as well as upon the use of drugs. In diseases of the spleen Philagrios attained to a position of authority which endured for centuries and which he owed to the care which he bestowed upon the finer diagnostic points (so far as was possible with the means available in his day). Like his predecessors, he knew that in intermittent fevers and in many acute infections enlargement of the spleen occurred; he taught that the spleen, through various dyscrasiæ, particularly the cold, also through inflammation, undergoes enlargement, shrinking, induration and scirrhus and refers to the coughing of sufferers from spleen affections. Treatment, which varied according to the supposed dyscrasia and the stage of the disease, consisted in dietetic measures, external applications, venesection, laxatives, emetics and diuretics. Against gout he recommended friction with oil and brine; amongst intestinal affections he described fatty diarrhœa; he

attempted the cure of spermatorrhœa by sedative diet, walking, gymnastics, massage, absence of psychic stimuli, suitable measures adopted during sleep (avoidance of dorsal decubitus, sheets of lead under the loins). Philagrios wrote exhaustively upon renal calculi; these were of frequent occurrence in old people, varied greatly in size, shape, colour and surface, were found in the hilum of the kidney; as symptoms are to be reckoned pain in the renal area, frequently also obstipation; long-standing inflammation of the kidneys manifests itself by swelling, pain on stooping, abnormalities of the urine. Impaction of a stone in the urethra was treated by Philagrios by urethrotomy above the glans. Philagrios excelled as a gynæcologist and surgeon; in his treatment of ganglion pressure played the chief part.

Of the writings of Poseidonios only scanty fragments have survived, although they assume no little importance in their relation to ancient psychiatry. He considered the essence of phrenitis to be an inflammation of the meninges, and distinguished three forms, according to the involvement of imagination, reason, or both together. The three intellectual faculties were localised by Poseidonios, imagination in the anterior part of the brain, reason in the lateral ventricles and memory in the hinder part of the brain. This doctrine of the three organs of the soul, which may be looked upon as the first attempt at cerebral localisation, long held its own in psychologic and psychiatric literature. In the treatment of phrenitis use was made of suitable environment (a warm or cool, light or dark room, according to the case), lukewarm fomentations, clysters, venesection, also narcotics, although the last were to be used only upon moderation of the paroxysms, and in no case continuously. Lethargy arose in one of two ways, the brain being primarily or secondarily affected; lethargy also ensued in the course of chronic affections or cerebral inflammation, particularly if this were treated by immoderate use of narcotics. Treatment consisted in a warm, well-lighted sick-room, perfumes (*e.g.*, castoreum), sternutatories, warm compresses to the head, shaking the patient, eventually enemata and venesection. Carus was to be distinguished from lethargy by the degree of disturbance of consciousness: in the latter the patient responded to interrogation and did not lie speechless; in carus, on the other hand, he lay wrapped in profound slumber and, whilst sensible to external stimuli, was neither able to speak nor to open the eyes. Coma was characterised by unnatural sleep, wandering in speech, an open mouth, catalepsy by unconsciousness and insensibility. Vertigo was brought about by the mounting of warm and acrid emanations to the head, particularly during digestion and on waking in the morning; if the complaint continues attacks may be precipitated by very trifling causes (such as the sight of a wheel in movement); the most important prophylactic and curative measure consists in the promotion of free evacuation. Nightmare was not (as was generally believed) of demoniac origin, but was due to the accumulation of thick cold vapours in the cavities of the brain, which prevented innervation; the aim of treatment was the evacuation of noxious juices or the obviation of plethora; in addition, compresses to the head and woollen coverings at night. Nightmare was frequently the presage of apoplexy, mania or epilepsy. Convulsions in epilepsy arose from the presence in the nerve centres of some foreign constituent of which they strove to rid themselves. Cure of epilepsy in the aged and newly-born was considered impossible. Mania arose from excessive determination of blood to the brain or by accumulation of waste blood or bile in it, predisposing causes being weakness of the head, choleric temperament, potus, faulty digestion and suppression of menses. Varieties of mania are many, some recurring periodically. When mania arises from blood alone the patient is seized with interminable laughter, seeing objects of mirth, he assumes a merry expression and sings constantly; at times the rising vapours convey to him sounds as of a flute; memory is unimpaired, as may be seen from the fact that patients sing familiar songs, whereas imagination and reason suffer. When bile and blood are mingled the mixture acquires an acrid character, as though the brain and meninges were pricked and bored. The patients are turbulent, quarrelsome and give way to raving and fury. Treatment: thin fluid diet, venesection, baths, compresses, later emmenagogues, expectorants, etc. Treat-

ment for melancholia was laid down upon similar lines. Poseidonios gives a detailed and life-like description of lyssa, in which the symptom of hydrophobia is explained by the occurrence of terrifying apparitions seen by the patient in the contents of his drinking-vessel. A philosopher, having been bitten by a mad dog, bore his sufferings with noble resignation; seeing in his drinking-vessel the apparition of the animal he yet reflected that there could be nothing in common between the vessel and the dog, forced himself to drink undismayed, and was cured of his disease (hysterical hydrophobia?). In the treatment of lyssa, amongst other things, enlargement and cauterisation of the wound, scarification of the surrounding parts and encouragement of suppuration were employed. In order to discover whether the suspected dog were really mad or completely cured of the disease, a poultice from the wound was given as food to a hen; if she were none the worse of eating it no danger was to be anticipated. The above examples make it comprehensible that the methods of treatment of Poseidonios, which were founded upon his predecessors—*e.g.*, Aretaios, Archigenes, Ruphos, Galen, etc.—as well as upon his own observations, served as a mine of information for his successors in questions concerning neuroses and psychoses.

The Latin literature of this period is of no slight historical importance and clearly indicates the trend of occidental medicine. The extant writings fall naturally into two groups, scientific or partly scientific and those dealing purely with folk-medicine. To the former category belong fragments of Vindicianus, the scientific endeavour shown in which is not to be gainsaid, and the "*Medicina Praesentaneae*" of his pupil Theodorus Priscianus, who, however, paid too great a tribute to the empiricism of the age in his choice of remedies. It is noticeable that the humoral pathology and the theoretical and practical teachings of the dogmatists are equally represented.

Vindicianus hailed from Africa and was both contemporary and friend of St. Augustine. All that has survived of his works, excerpts from *Gynæcia*, deal mostly with anatomy, embryology and physiology, and are partly inspired by very early sources. In the introduction is the statement that, whereas the ancients undertook human dissection, this practice was now forbidden. Amongst the physiological maxims, which contained much of interest, are statements upon the functions of brain and heart, showing that the conflict concerning the seat of the psychic functions was by no means ended. "*Cerebrum est medulla capitis . . . quod multum copiosus habemus quam reliqua animalia, ideoque omnibus illis sapientiores sumus . . . cerebrum autem semper sui commovens sensum ideoque salire non cessat . . . cor duas aures habet, ubi mens hominum animusque commoratur, unde quicquid nobis iudicii est, venit per ipsas cordis aures, omnis et cogitatio extollit.*" Vindicianus also wrote a therapeutic work, "*De expertis remediis*," much used by mediæval authors, but no longer extant.

Theodorus Priscianus was court-physician under Gratianus. His only surviving work is the "*Euporiston*" or "*Medicina Praesentaneae*." This work of Priscianus is divided into four parts: the first book deals exhaustively with external affections, the second with internal, the third with diseases of women, after which comes the "*Physica*," incomplete and dealing with supernatural popular remedies. His doctrines, inclining towards empiricism, are indicated by the author in his preface, wherein he inveighs against the meticulousness of physicians, defends the use of simple and homely measures, whilst he includes an interesting and somewhat satirical skit upon the physician's demeanour at the bedside. Priscianus gives only casual clinical descriptions, unites humoral pathology with the view of the methodists and

lays chief stress upon formulæ in his therapeutics. In the latter, vegetable remedies are the most important, although he makes more frequent use of mineral drugs than most authors, and displays also a predilection for filthy substances. Superstitious procedures are in frequent use. His inspiration is mostly drawn from Dioscurides and Pliny. Notable facts are that he employs diuretics in the cure of asthma, makes use of magnetic ore for headache, advises psychic treatment in aphasia (frightening with snakes or fire) and, amongst vermifuges, recommends the use of *santonin*. In the introduction to the "*Physica*" he defends the use of supernatural methods by references to many great precursors, and complacently looks forward to the applause of posterity.

The so-called "*Medicina Plinii*," the "*Liber de medicini ex animalibus*" of Sextus Placidus Papyrensis and the "*Herbarius*" of "*Lucius Apuleius*" (end of fourth or beginning of fifth century) deal with folk-medicine. The source of inspiration of the above-mentioned writings is the Natural History of Pliny. This agglomeration, in spite of its small value, was for centuries held in high esteem.

The formulary of Marcellus Empiricus, dating from the commencement of the fifth century, is an *olla podrida* made up of extracts from every imaginable author and partly from medical folk-lore; a compendium of the most absurd superstitions which later acquired great popularity.

The Christian author Marcellus Empiricus, *magister officiorum* (minister of the interior) under Theodosius I., devoted the greatest enthusiasm to the compilation of his voluminous formulary, "*De medicamentis*," primarily intended for the use of his sons, a book which constitutes the most significant expression of the superstition of the age. Philanthropic motives led the author to compose the volume, which was meant to be of use to poor patients in time of need, whilst he is honourably distinguished from most compilers in that he does not break out into diatribes against other physicians, but expressly enjoins that, in the preparation of remedies, medical advice be sought. He derives much direct inspiration from folk-medicine, which lends his work its characteristic colouring and is, from the point of view of the historian of civilisation, most instructive. Herein can be seen how ancient oriental, Græco-Roman and western European elements unite into a whole of craziest superstition, and many sidelights are thrown upon the age and origin of some of our present-day popular medical customs. The reader is referred to the original, but it may here be pointed out what an intimate connection exists between pagan superstition on the one hand and that of Jews and Christians on the other. Thus buckthorn is esteemed as a miracle-worker of proven efficacy because Christ was crowned with these thorns; in the gathering of a certain plant a formula was to be repeated in which the name of Christ occurred—"terram teneo, herbam lego, in nomine Christi, prosit ad quod te colligo"; the superscription upon an amulet contains an adjuration, "in nomine dei Jacob, in nomine dei Sabaoth." The large number of plant names endows the book with considerable importance from the point of view of botany and philology.

A peculiarity of later Latin medical literature pregnant with consequences for the future consisted in the fact that, in addition to humoral pathology, it accorded recognition to methodic principles, particularly in the domain of therapeutics. So far as occidental medicine is concerned neither humoral nor Galenical pathology held undivided sway, Galen, in contrast with Hippocrates, being ignored to a surprising extent. The

high esteem in which the "Medicorum princeps," the great Soranos, was held amongst physicians is proved by the fact that it was considered necessary to make his teaching, in Latin translation, easily accessible to the general public. This was effected by the author Cælius Aurelianus of Sicca Veneria in Numidia—upon linguistic grounds presumably about the fifth century, other criteria being wanting.

Cælius Aurelianus displayed a wide literary activity which included all branches of the medical art and constituted an exposition of the entire theoretical and practical content of the methodic system, rounded off for didactic purposes. We have him to thank for the greater part of what knowledge we possess of the methodic school. This literary and historical significance is overshadowed by the important position accorded to Cælius Aurelianus in the evolution of medicine. His writings or extracts from them stand as a beacon-light of rational medicine in the West, merged as it was in barbarian darkness; as a rampart against overwhelming superstition to be replaced only by the later preponderance of Galenism. The merit of having, at the psychological moment, preserved methodism in Latin garb for future generations was, as it happens, rewarded in unusual fashion. The fame which posterity as a rule lavishes upon original creations alone was accorded to the productions of an author whose actual achievements only consisted in more or less free translations of the works of Soranos, with occasional additions of his own.

The masterpiece of Cælius Aurelianus, "*De morbis acutis et chronicis*," constitutes a compendium of medicine and, more than any other writing of antiquity, is in its whole design in uniformity with modern requirements. After exhaustive definition of nomenclature and technicalities each disease is clearly and succinctly described (the material being arranged upon the principle "*a capite ad calcem*") according to ætiology, symptomatology, pathology (frequently with anatomical additions), diagnosis and treatment, use being made of all precedent literature, from Hippocrates to Soranos. It contains a great number of admirable observations, differential diagnosis is developed with an accuracy and a clearness to be found in no other author—methods of physical examination receiving attention—an astonishing breadth of view is displayed in the therapeutic recommendations, which consistently exclude all supernatural and drastic methods (blood-letting to faintness, many operations) and rely in great measure upon mechanical, dietetic and hygienic means, particularly in chronic ailments (gymnastics, massage, exercises of many kinds, medicinal baths). Not all the sections are equally copious—those upon neurology and psychiatry being of especial merit—but everywhere mention is made

of divergent or opposing opinions and nowhere does the polemic overstep the bounds of decorum—which is far from being the case with Galen. All these advantages may ultimately be traced back to the master of the methodic school, Soranos, who, to Cælius Aurelianus, was the culminating point of all medicine.

DISEASES OF RESPIRATION.—Cough is usually a symptom underlying various diseases but may arise independently, the chief part in its treatment is played by inhalations of steam. To relieve aphonia sponges saturated with cold water were ordered to be placed around the neck, or, in bad cases, blood-letting was performed. Phthisis, from a variety of beginnings, particularly hæmorrhage from the lungs and constant coughing, develops into a characteristic clinical picture. The masterly description shows that attention was paid to the nature of the sputum and the sound of the breathing. The treatment of phthisis is described according to the principles of the methodists; in addition to medicaments, baths and diet cures take an important place. Sea-voyages and vocal exercises are likewise considered. Cælius Aurelianus distinguishes “atrophy” of the lungs and empyema from phthisis. In the section upon pleuritis the divergent opinions of his precursors are referred to, but the correctness of Soranos’ definition of the disease is defended—pain in the side associated with fever and cough. The disease occurs chiefly in winter and attacks men and old people rather than women and youths. The principal symptoms are fever, pain radiating upwards, dyspnœa, cough, sometimes dry, sometimes associated with expectoration; the tongue is coated, the patient suffers from sleeplessness and can only lie upon the affected side. Exacerbation of the symptoms follows increase of the disease, whilst to these may be added affections of the joints, diarrhœa and delirium. The auscultatory phenomena are referred to by Cælius Aurelianus when he mentions under symptoms: “gutturis stridor vel sonitus interius resonans aut sibilans in ea parte, quae patitur.” Venesection plays a prominent part in the carefully regulated therapy, it being categorically laid down that the operation take place on the sound side. The symptoms of pneumonia are fever, accelerated and laboured breathing, sensation of pain in the chest, cough, variable expectoration, air-hunger, quick pulse. Evidences of aggravation of the disease are distention of the thorax, sweating and certain auscultatory phenomena: “sibilatus vehemens atque asper,” “in ultimo etiam pectoris resonans stridor.”

DISEASES OF THE DIGESTIVE APPARATUS.—The “*morbus cardiacus*” is distinguished from the not less problematical “*passio stomachica*.” The disease named by Cælius Aurelianus “*passio ventriculosa*,” *i.e.*, habitual diarrhœa, follows upon long-continued disorders of digestion, abdominal inflammations and dysentery. The method of treatment is laid down with astonishing care; of particular interest to us is, in addition to general dietetic measures, the prescription of enemata and suitable food. Superficially seated tumours are distinguished from those more deeply placed by the fact that in the latter the skin over them can be picked up in a fold. In flatulent abdominal distention (*meteorism*) the parts are difficult to compress and resume their previous position upon cessation of the pressure, in œdema, on the other hand, the impressions of the fingers remain. On tapping the belly with the flat hand (*percussion*) a tympanitic sound is heard in the first instance, but not in the second.

Signs of nervous irritation in children are excellently described, such as restlessness, grinding the teeth, crying out in sleep, twitchings, etc. Enlargements of liver and spleen are carefully described, *e.g.*, prominence of the superficial abdominal veins, tendency to varicose ulceration of the legs and cloudy urine are mentioned. Cælius Aurelianus doubts whether extirpation of hepatic tumours, recommended by many, will ever actually be performed.

DISEASES OF THE UROGENITAL SYSTEM. Vesical calculi are associated with considerable pain, which radiates to the pubes, navel, perineum and testis; diagnosis is effected, not only

by subjective symptoms and examination of the urinary sediment, but also by the use of the sound. "Nephritis" (*passio renalis*) runs its course with fever, constipation, abdominal pain and vomiting, leading eventually to a condition of weakness and emaciation; the urine appears at times fatty or ichorous, inflammation may extend to the ureters. Possible causes of the disease are chills, spiced foods, digestive disturbances, injuries, abuse of diuretics.

DYSCHASIE.—Gout is commoner amongst men than amongst women, and is particularly prevalent in certain neighbourhoods. As symptoms are enumerated: formication in the limbs, disturbances of digestion and respiration, and a choleric disposition. The chief treatment consists in drinking from certain springs. Dropsy is divided by Cælius Aurelianus into a generalised form and a local one, confined to the abdominal cavity.

DISEASES OF THE NERVOUS SYSTEM AND PSYCHOSES.—"Paralysis" signifies strictly paralysis of sensation and movement or of only one of the two. There are two main forms of paralysis, spastic and flaccid. In the wider sense "paralysis" connotes interference with function in general, whereby are included many pathological manifestations not strictly neurological in their nature.

In addition to paralysis of the extremities Cælius Aurelianus describes "paralysis" of the eyelids, pupils, tongue, smell, lips, chin, gums, œsophagus, larynx, stomach, intestines, bladder, etc., and considers it highly probable that other organs also, such as the lungs, heart, diaphragm, spleen and liver may be attacked with paralysis. Of far greater value than the diagnostic portion of this section is that upon treatment, since particular emphasis is laid upon mechano-therapy and exercises. Thus Aurelianus recommends for the cure of speech-defects and stammering, which are clearly differentiated, purposeful exercises in articulation, methodically graduated from the easy to the difficult.

The chief difference between apoplexy and paralysis is simply put by Aurelianus in describing the one as an acute, the other as a chronic ailment. From the description of convulsive disorders it appears that tonic and clonic forms were distinguished, amongst which were *emprosthotonos*, *episthotonos*, tetanus and *spasmus cynicus* (convulsive tic). Epilepsy is admirably described with the inclusion of many details, infantile convulsions and puerperal eclampsia not, however, being differentiated. Epilepsy is distinguished from hysterical manifestations of a similar nature by the more profound disturbance of consciousness in the former. "Incubo" or nightmare he regarded as half-way to epilepsy. In the treatment of cases of phrenitis care had above all to be taken to ascertain whether "*strictura*" or "*olutio*" be the underlying cause. The former demanded withholding of all exciting influences, the latter employment of stimulating methods. The opposite condition to phrenitis, viz. lethargy, was not to be confused with other similar conditions, such as poisoning with *mandragora* or *hyoscyamus*.

DISEASES OF THE SKIN.—Concerning leprosy it is a point of interest to note that complete segregation of lepers was recommended by many physicians in order to avoid the danger of contagion.

A contrast with the masterpiece of Cælius Aurelianus, although of far less value, is formed by the compendium of Cassius Felix, with which the medical literature of Western Rome comes to an end. The author—to judge by the barbarous Latin and Punic expressions in the text—hailed from North Africa, and his intention, as set out in the preface, was to present an epitome of the theoretical and practical teachings of the dogmatic school. The writing was published in 447 A.D., and its full title is: "*De medicina ex graecis logicae sectae auctoribus liber translatus sub Artabure et Calepio consulibus.*" It is mainly a work upon specialised

pathology and therapeutics, the former being somewhat scanty, the latter mainly derived from the therapeutic works of Galen, and is arranged according to the favourite principle "a capite ad calcem." Thus it came to pass that, at the close of this period of antiquity, both Soranos, "medicorum princeps," and the physician of Pergamos found expression through the medium of Latin writings.

The divorce between East and West which, under Byzantine influence, had gradually led to the development of an entirely peculiar civilisation, left its traces also upon the medical literature of the fifth century. In the Hellenic East tradition maintained its sway, whilst in the West, reverting as it was to barbarism, this decayed and finally fell into ruins. In Byzantium, capable, high-minded physicians carried on their work—such were Hesychios and his famous son Jacobos—and, if often disguised by sophisticated affectation, erudition still blossomed in the long famous and time-defying city of Alexandria. This was ever the foremost seminary for disciples of medicine, here laboured learned iatrosophists like Palladios and Severos, here the erudite, many-sided Asclepiodotos was born, a man endowed with the true spirit of the investigator, who under more favourable conditions might well have inaugurated a new era of natural philosophy and medical progress.

Hesychios of Damascus settled in Byzantium in 430 A.D., having practised with great success for forty years previously in various places. A much higher reputation was attained by his son Jacobos who became comes archiatriorum under the Emperor Leo (457–474) and was known to his contemporaries as the "Zeuxis and Pheidias of medicine." His fame rested, not alone upon his comprehensive medical knowledge and practical ability, but also upon his ardent philanthropy and his rare disinterestedness; the honour which all classes enthusiastically paid him found expression in the title *Σωτήρ* (saviour) and more tangibly in the erection of a statue.

The literary activity of Jacobos is represented by one or two prescriptions preserved by later authors, also by the statement that he attached great value to a cooling and fluid diet, which fact led to his being known as Psychrestos. "A good physician," so runs one of his aphorisms, "must either relinquish his patient at once, or else not give him up till he has ameliorated his condition." Great fame as a worthy follower of Jacobos was attained by the versatile, keen-witted and learned Asclepiodotos, an investigator who, despite his adherence to the neo-Platonic school, inclined to the realistic method, herein an exception in his extravagant age.¹

In addition to medicine and philosophy Asclepiodotos pursued zoological, botanical, mathematical and physical studies with devoted zeal, everywhere striking out paths of his own. In medicine he honoured Hippocrates and Soranos as patterns; he favoured more

¹ Damascios, the last teacher in the philosophic school of Athens, expressed himself as follows upon Asclepiodotos: "From youth upwards he was recognised as the quickest-witted and most scholarly of his contemporaries, being unwearied in the search for all that was marvellous in nature or in any art. Thus in a short time he learnt the blending of pigments and dyes used in the embellishment of clothes, also the thousand-fold varieties of wood, with tortuous or straight grain. Moreover, he observed and investigated the peculiarities and shapes of stones and plants, not of the common

energetic therapeutic measures than most physicians of his day and furthered his practical attainments no little by the influence of his friendly and genial nature, which is universally commented upon.

Commentaries upon the Hippocratic writings from the pen of the iatrosophist Palladios are in existence, which give the clearest insight into the subtle but fruitless methods of the Alexandrians of the day. He is, in addition, the probable author of a treatise upon fevers, *περὶ πυρετῶν σύντομος σύνοψις*, several extracts from which are worthy of quotation. Fever is defined as unnatural heat which, originating in the heart, spreads by way of the arteries throughout the entire body and causes a disturbance of the corporal functions perceptible to the senses. Morbid humours cause fevers only when they reach the heart. Fever-heat follows upon rigor because the blood, dammed back into the interior of the body, doubles the natural warmth of the heart, which then is disseminated through the arteries. In intermittent fevers the morbid matters are withdrawn in the interval into the muscles and by their return to the blood bring about a fresh attack. Septic fevers depend upon destruction, benign fevers upon simple heating of the blood in the vessels. Hectic fevers undergo exacerbation after consumption of food—just as unslaked lime is heated by the addition of water.

ones alone, but of the rarest varieties. He gave endless trouble to artisans, seeking their society constantly and putting the most searching questions to them. He attached great importance to the natural history of plants and still more so to that of animals, differentiating the indigenous varieties by personal observation and the foreign by soliciting information concerning them and reading the writings of the ancients."

MEDICINE IN THE WRITINGS OF THE FATHERS OF THE CHURCH

THE Fathers of the Church found frequent opportunity to touch upon medical questions, notably in discussions upon the Christian life. Clemens Alexandrinus and Hieronymus in particular deal with dietetics and hygiene, inveighing strongly against gormandising, drunkenness and debauchery, although, in contrast with many sects, not absolutely prohibiting the use of meat and wine. Thus Clemens Alexandrinus says: "Who makes immoderate use of wine, a drug, requires another drug against the wine." "I admire those who have chosen a life of moderation and desire only the drink of temperance, water, who shun wine as they would danger from fire. It suffices that youths and girls should in general be denied this drug. . . . Grown-up people cannot be prevented from consuming a more heating drink . . . but even for them there is a limit. . . . I remember that a certain Artorius expresses the opinion that, in order to enjoy long life, only so much should be drunk as suffices to moisten the food." "Water, as well as wine, is a creation of God, but the former is a necessity, the latter a remedy in weak health." "In the use of baths there are four motives: cleanliness, warmth, health and pleasure. For pleasure one should not bathe; women should bathe in the interest of cleanliness and health, men in the interest of health alone. The motive of warmth is superfluous, for limbs stiffened with cold can be warmed in other ways. Continuous use of baths, however, induces weakness and saps the natural energy; it often leads to lassitude and faintness."

Hieronymus, who has left a most interesting summary upon the diet of various nations, utters a warning against over-eating and drinking, holding the excessive consumption of meat in particular to be injurious to health. "Whoever is ill," he says, "recovers health only through restricted expenditure and a rigid mode of life, *i.e.*, through meagre diet. The food which serves to restore health will also preserve it. None need think that vegetables cause disease. If, however, they do not give rise to such strength as was possessed by Milo of Crotona, which only results from flesh-eating, one may well ask, why is it necessary that a wise man and a Christian should possess that which, in the case of soldiers and fighting men, only excites them to vice?"

The Christian apologists acquired a real interest in medical questions, however, in the defence of certain theses, such as the existence of the soul, the resurrection of the body and design in nature. In this connection matters of physiology and psychology came chiefly to the fore, the most prominent writer being the learned and keen-witted Tertullian, who in many places makes use of medical similes and technical terms. The soul he looks upon as of the body (although not crudely material), a conclusion which is drawn from the fact of its sentient faculty. The highest centre of life and thought is placed in the blood. The highest faculty of the soul is, however, not distributed throughout the entire body (Moschion), nor situated in the head (Xenocrates), nor in the brain (Hippocrates), nor in the base of the brain (Herophilos), nor in the meninges (Erasistratus), nor midway between the eyebrows (Strato), nor in the chest (Epicuros), but in the heart. Asclepiades sought to prove, by experiments on animals, whose heads he cut off (flies, wasps, grasshoppers), or whose hearts he tore out (goats,

tortoises, eels), that no higher faculty of the soul existed: against him and his adherents Tertullian directed the words: "Asclepiades may seek his goats which bleat when their hearts have been removed, and may chase his flies, which fly without heads, and all those who think to draw deductions upon the disposition of the human soul from the structure of animals may know that they themselves live without heart and brain." The highest functions of the soul exist from the very beginning, as may be seen from observation of sucklings; education and surroundings condition the variations in intellectual expansion, growth of soul goes on parallel with bodily development, the sole natural impulse is that towards nourishment. Tertullian, with great emphasis, advances the view that the soul is not first united with the body at the moment of birth, but rather was begotten with it. He points to the foetal movements which are felt by pregnant women, and discusses also the "barbarity" of obstetricians who, in order to save the life of the mother, dismember the embryo.

Clemens Alexandrinus, in the refutation of an agnostic allegory, seeks to prove that milk is only altered blood, and also goes into details upon sexual matters. The formation of the embryo results from the union of the semen with the purified remains of the menstrual blood; the power inherent in the semen influences the nature of the blood and causes it to coagulate as rennet does milk. The apologists sought to establish the possibility of the resurrection of the body by comparison with the origin of the complicated human form from a tiny drop of semen. More interesting from a medical point of view, however, is the objection which Methodios (ca. 312), in his dialogue upon resurrection of the body, puts into the mouth of the physician Aglaophon. The latter asks which body is to rise again, that of the child, of the youth or of the old man, and instances the constant transformation of the human body through tissue change.

A fruitful field offered itself to the Fathers in the teleological view of the human body. This holds an important place in the work of Dionysius Alexandrinus, "De natura," and serves as a potent argument against atomism. "The use of the limbs," says Dionysius, finally, "is the same in wise and foolish alike; but the latter have no knowledge concerning this . . . they ascribe its continuance, so great a wonder, to fortuitous concurrence of atoms. Physicians, however, who have more closely examined these matters and who have, in particular, made more detailed examination of the internal processes, have, filled with wonder, admitted the divine workings of nature. Lactantius, in his work "De opificio dei," has treated the subject in comprehensive fashion in its anatomical, physiological and psychological bearings. He exemplifies, particularly in adherence to Aristotle and Varro, the purposefulness of the bodily structure and function in all its then known details. He recognises the countless varieties in the world of the living in spite of the unity of the fundamental life. Ocular convergence had its limits and was only brought about by intention. Perception of taste was situated, not in the gums, but in the tongue. In his description of the internal organs of reproduction, and in particular of their bilateral position, Lactantius instances the findings in animal cadavers. The two theories upon the origin of semen: *ex medullis*, *ex omni corpore*, are held to be uncertain. Male embryos spring from the right side, female from the left. Development begins, not with the heart, but with the head, as may be seen from observation of embryos of birds. Determination of sex depends upon the predominance of male or female seed, but it is not always a matter of indifference whether conception occurs in the right (male) or left (female) half of the uterus; thereby is explained the origin of male individuals with feminine characteristics and vice-versa. In his psychology Lactantius takes notice of the different theories, and whilst leaning to the assumption that the site of reason is in the head, maintains a sceptical attitude on the subject.

The saying of Gregory of Nazianzen: "Consider, O man, how thou art made and shaped, and how greatly God's wisdom showeth itself in thy creation and the secret of nature contained therein," animates also the writings of Gregory of Nyssa and Nemesios of Emesa upon natural philosophy, and is to be taken into consideration in criticising their anatomico-

physiological contents, which serve only as a pedestal for theology. In the treatise of Gregory of Nyssa, "Upon the creation of man," is the important statement: "Concerning the exact disposition of our body, every individual learns from what he sees, experiences or feels, and therein he has his own nature as instructor. Nevertheless we can accept the representations of these things in books by scholars of renown, and make a close study of them. If, however, any one should prefer the Church as a teacher upon all these matters, so as to require instruction from no outside source, we will here provide a brief dissertation upon them."

Three forces, according to Gregory, maintain life: the first permeates the whole with warmth, the second provides moisture to that which is warmed, the third holds the limbs together and endows every one with the power of independent and voluntary movement—three organs are absolutely essential to life: heart, liver, brain. Flesh is capable of sensation; movement results from force conveyed through the nerves, its origin is in the meninges, the rupture of which causes instant death. The entire body is permeated by canals, some of which spring from the heart and contain pneuma (arteries), whilst the others arise from the liver and contain blood (veins). Pneuma reaches the lungs by the process of respiration and is drawn from the heart. The respiratory process occurs involuntarily, the heart attached to the lung, by its contraction alternately draws it out (enlargement) and compresses it, whereby inspiration and expiration take place. The stomach, the heat of which is maintained by the heart, yearns after food the more the greater the amount of heat it absorbs; digestion is a process of coction of matter, which is divided into coarser and more refined portions. The residuum passes through the intestines and for a time provides them with nourishment, the many convolutions serve the purpose of retarding evacuation so that appetite may not recur too rapidly. The liver, to which pneuma is brought by means of an artery, whereby the blood acquires its red colour, lies at so great a distance from the heart in order that the two sources of vital force should not be brought together in too confined a space. The vapours originating from the admixture of moisture and warmth nourish the brain, the coverings of which are prolonged in a tube-like fashion through the spinal column. All the different constituents of the body are fashioned in the most marvellous manner from the same nutriment. Hairs are formed by the escape of vapours through the pores, long and straight ones when the emanations take a direct path, wavy or curly ones when they are expelled through tortuous channels.

Nemesios of Emesa has no greater claim to originality in anatomico-physiological matters than Gregory of Nyssa, although it is much to the credit of the theologians that, with zeal and thoroughness, they should have steeped themselves in the technical writings of Aristotle and Galen, in order to place their psychological studies upon a firm foundation. The treatise of Nemesios, *περὶ φύσεως ἀνθρώπου*, was widely known in the Middle Ages, and was early and repeatedly translated into Latin. In his doctrine concerning the soul the Patristic philosopher made use of the hypothesis of the *πνεῦμα ψυχικόν*, which serves as an explanation of the influence of mind over body, of the perception of the senses, etc., and, following Poseidonios, he placed the power of imagination in the anterior, of reason in the lateral, of memory in the posterior ventricle of the brain. The mental and bodily constitution of man he looked upon, not as an isolated, unique phenomenon, but as the culminating point of creation, in which there is a gradual ascent from the inorganic world to the most perfect being. He held that the semen was fashioned in the brain, was then led down by way of the vessels behind the ear and deposited in the testicles (this doctrine had, since the days of Pythagoras, been widely spread throughout the literature). The lung substance was frothy flesh; bile assisted digestion and hastened evacuation of the bowels; nerves were distinguished from tendons by their sensibility. These and other observations were for a time quite erroneously held to be peculiar to this author, and detractors of Harvey even went so far as to credit Nemesios with an anticipation of the circulation of the blood. His actual words are quoted, in order that the unbiassed may convince themselves of the untenability

of such perverted interpretations: "The movement of the pulse originates from the heart, particularly from the left chamber, the so-called pneumatic, which distributes the vital warmth through the arteries to all parts of the body, just as the liver distributes nutriment by means of the arteries. . . . When the pulsating vessel expands it draws into itself blood from the nearest vein, which serves as nourishment to the vital spirit; when it contracts it expels all impurities throughout the body and from the invisible pores." There can therefore be no question of any independence of view or even of any far-reaching discoveries in medicine, and it is no injustice to Nemesios to say that he contributed to the maintenance of the physiological views of antiquity. A greater merit, however, is his, that, in the same writing, he vigorously opposes dream-interpretations—wherein he was indeed before his time.

The doctrine of St. Augustine (354–430 A.D.), that the foetus developed a soul in the second month and was sexually differentiated in the fourth, later played an important part in legislation; his view upon the culpability of purposely induced abortion exercised great influence.

MEDICINE IN THE TALMUD

IN the writings of authors of antiquity isolated references are made to Jewish physicians, whilst it is probable that these took an active part in the intellectual life of Alexandria, but nothing is known of any medical literature emanating from them. Under these circumstances, the only information afforded us concerning the medical art of the Jews in this era is derived from the Talmud, the date of origin of which extends from the second to the sixth century.

In making use of this source, however, it must be borne in mind that, for the most part, it only reflects popular medical conceptions and that the Talmud, from its character of a law-book, deals for the most part with medical matters only in so far as ritual and civil and criminal law were thereby affected.

The medicine of the Talmud is copious but naturally unsystematic ; at times displaying an astonishing knowledge, whilst at others hardly showing any tendency to reach a higher standard. Now initiative and originality are in evidence ; again, foreign influences are dominant ; of these the Hellenic (in addition to the older Egyptian, Babylonian and Persian) are the most important, having made their way through Syria and Alexandria, manifesting themselves in many modified disease and drug names.

The question whether any relationship existed between medicine in the Talmud and mediæval medical art in the West, and the nature of such relationship, is worthy of consideration. In view of the importance of Jewish physicians in the Middle Ages it is conceivable that much may have been added to medicine in general which originated from the encyclopædia of the Talmud.

The physician of the Talmudic era dominated the entire art of healing ; in co-operation with him were the blood-letters, who carried out blood-letting, cupping, and even circumcision ; midwifery—except in particularly difficult cases—was in the hands of midwives. Physicians prepared their remedies themselves. Concerning their education we have no intimate knowledge, professional practice appears to have been subject to approval by authority ; in cases of proved negligence the physician seems to have been held responsible.

The number of physicians was by no means small; they constituted a *conditio sine qua non* for every community of any size, and were consulted in doubtful cases of ecclesiastical law, as experts in estimation of legal punishment and, especially, in all questions of public hygiene. But few men are designated in the Talmud with the exclusive title of physician, although it is stated of several teachers that they were skilled in the art of healing. The majority of scientific and medical sayings are ascribed to the Babylonian Mar Samuel (165-257), who stood head and shoulders above all others as a physician and was also renowned as an astronomer. The profession of medicine was held in high esteem, although folk-medicine maintained its position in addition to the scientific art.

ANATOMY, PHYSIOLOGY AND EMBRYOLOGY

Here and there scientific investigation was undertaken upon animals and embryos.

Osteological data were derived from examination of the human body,¹ but the greater part of the current knowledge of anatomy—as the teaching upon the viscera proves—was founded upon observations made in the slaughtering of animals. Interesting from an anatomical point of view are the statements concerning congenital or acquired bodily deformities—which disqualified from priestly service; included in the long list are abnormal shape of head, gibbus, genu varum and genu valgum, flat-foot and polydactylism. Concerning the functions of the different organs a popular tradition laid down that “the kidneys advise, the heart proves, the tongue measures sounds, the mouth completes them, the œsophagus receives all kinds of food and passes them on, the windpipe produces the voice, the lungs suck up all kinds of fluids, the liver calls forth anger, bile subdues anger, spleen arouses laughter, the stomach causes sleep, the nose awakens.” In learned circles views of a totally different nature were here and there current, thus it would appear from an observation that the seat of reason was assumed to be in the “marrow of the skull.” It was known that extirpation of spleen and uterus in animals was not fatal,² that paralysis of the lower extremities was a sequence of injury to the spinal cord. According to Talmudic embryology the bones and tendons, the nails, the marrow in the head and the white of the eye were derived from the father, “who sows the white”; skin, flesh, blood, hair and the dark part of the eye from the mother, “who sows the red”: God imparts life and soul, the expression of the face, the sight of the eyes, hearing with the ears, speech of the mouth, skill to use hands to work and feet to walk, reason and insight. According to some, development begins with the head; according to others, from the navel. The duration of pregnancy is given as 271-274 days.

DIETETICS, HYGIENE AND PROPHYLACTICS

Care of the body was reckoned a religious duty. As regards diet warning is uttered against any sudden change and particularly against excess, which is liable to cause intestinal trouble. “If thy meal be a pleasure then hold thy hand.” Children should not become accustomed to meat and wine; a good breakfast and the daily consumption of fresh vegetables are of importance. It was regarded as harmful to eat without drinking. “He who

¹ According to the Talmudic authors the skeleton consisted of 248 bones. This number may have been arrived at through examination of the body of a person 16-17 years of age, subjected to boiling, whereby the parts not yet united by ossification may have fallen asunder. It is stated that the pupils of Ismael (ca. 100 A.D.) obtained and boiled the body of a condemned prostitute in order to test the traditional figures as to the number of bones. The physician Thodos, speaking as an expert, was able definitely to pronounce that a number of vertebræ laid before him could not have originated from the same man.

² Reference was made to the fact that Egyptian dealers extirpated the uterus in cows and swine before sale to foreign countries, so that the breed should not be perpetuated in other lands.

eats without drinking eats blood (*i.e.*, he consumes his own body), and this is the commencement of bowel troubles." Many dietetic rules were in vogue, dealing with the influence of certain articles of food. Thus it was said: "Broth of bats is good for the stomach, for the eyes and even more so for the bowels, but bad for the teeth. Eat salt after every meal and, after drinking, drink water and so thou shalt not come to harm." For the maintenance of health baths, massage and inunctions were recommended; venesection also enjoyed great popularity as a prophylactic measure, nevertheless warnings are uttered against excess and unsuitable employment of venesection in old people; blood-letting should at most be performed every thirty days, but after the fiftieth year of life less often. Its performance was forbidden in bad weather and upon astrologically unpropitious days; blood-letting was to be preceded by a very restricted diet, afterwards a nourishing but easily digested régime was ordered (amongst forbidden articles were cheese, onions, garlic, cress, poultry); exertion of any kind or coitus was considered harmful, and avoidance of chill insisted upon; strict injunctions were laid down against touching the wound. Many recommendations deal with the regulation of the *primæ viæ* (concentration of thought upon the act, alternate rising and sitting down in the closet, avoidance of straining, laxative measures, washing the hands after every evacuation) and sexual hygiene. Bodily work is expressly recommended for maintenance of physical and mental health. An important place is taken in the Talmud by the laws upon cleanliness and disinfection, wherein the principles of social hygiene are mostly veiled by ethico-religious and frequently even superstitious influences; extraordinary subtlety of thought is shown in the different degrees of impurity distinguished, measures necessary for purification being laid down. It would lead us too far to go into details, it need only be said that the ideas contained in these instructions are, in many cases, confirmed by modern science. Hand-washing before and after eating, after evacuation of bladder and rectum, after venesection, after cutting nails, the bath of purification for menstruating and lying-in women, measures for spread of disease may be mentioned amongst these. Most significant, too, are the regulations upon slaughtering of animals, upon compulsory inspection of meat and upon preparation of food. It is forbidden to eat of any slaughtered animal in the examination of which injuries or any pathological conditions are discovered and which would presumably have proved fatal. The discussion upon what is to be considered "kosher" and what "trepha" affords an interesting insight into an extraordinarily developed veterinary pathology. Amongst the conditions which render slaughtered animals unfit for food are: perforation of both walls of the œsophagus, severance of the trachea, perforation of the meninges, of the pericardium, fracture of the spinal column together with laceration of the spinal cord, defects of the lungs, of the intestinal tract, complete removal of the liver, perforation of the gall-bladder, suppuration or disorganisation of one kidney; as regards the lungs particular mention is made of perforation of the lung or pleura (air blown down the trachea escapes with a hissing sound), fistulous communication between the two bronchi, ulceration of bronchi, adherent pleura.

GENERAL PATHOLOGY AND THERAPEUTICS

Apart from the fundamental principle that sickness and healing were God's work, the most varied ætiological conceptions are represented in the Talmud, mystical as well as rational. Thus diseases are ascribed on the one hand to demoniac influences and the evil eye, on the other to cold, heat, to the air, bad drinking-water, faulty modes of life, to bile, plethora or to a disproportionate inter-relationship (between blood and water); the influence of heredity and infection, through persons and objects, is given special prominence. Medicaments were chiefly of vegetable, less often of animal origin. Apart from drugs, the therapeutic efficacy of sunlight, of baths and change of air was well understood. Venesection played an important part amongst remedial measures, particularly at the commencement of an illness; warning is given, however, against abuse of venesection, against its performance in

the upright position, at the acme of a fever. Great attention was paid to dietetic régime in the treatment of the sick; dietetic remedies and drinks were known and to certain foods specific remedial efficacy was ascribed. Psychological insight is evidenced in the exhortation, not to be despised at the present day, that even in incurable disease special directions should be given as to diet. Various dietetic rules were current, *e.g.* the following: "Ten things bring the patient back to his sickness, so that it becomes worse: consumption of beef, oily fish, roasted flesh, poultry, roasted eggs, cress, milk, cheese, shaving and the vapour bath; with many, also, eating nuts and cucumbers. Six things cure the patient, and the cure is a lasting one: cabbage, beetroot and camomile, rennet-bag, uterus and liver and, in many cases, small fish.

SPECIALISED PATHOLOGY AND THERAPEUTICS

Fever was looked upon as a reaction phenomenon, occasionally of a useful nature; various forms of essential fever were recognised. Treatment consisted in dietetic measures (initial fasting), venesection or was carried out upon lines laid down by popular superstition. Large crowds and famine were recognised as conditions favourable to the commencement of epidemics, whilst the fact was realised that these could be disseminated and protracted by means of caravans, animals (*e.g.* pigs), etc. Amongst diseases of the mouth are mentioned fœtor ex ore, ranula, stomatitis, abscess; the frequently mentioned "askara" corresponds with epidemic croup. Under the title "polypus" of the nose, ozæna is, from the context, to be understood; for nose-bleeding a complicated form of tampon was recommended. Ear diseases were treated, if associated with discharge, by means of hard remedies (*e.g.* rock-salt), otherwise with fluid ones. In order to ascertain whether blood coming from the mouth originated in the lungs, it was to be touched with a white straw, if it adhered, this was a positive sign. Frequent mention is made of digestive disturbances, obstruction of the bowels, etc., with their prevention and cure. A chief place amongst intestinal affections is taken by dysentery. In abdominal pain and bowel trouble warm inunctions were recommended, also application of hot cloths, of a bowl of hot water, drinking old wine, peppercorn in wine, etc. Hæmorrhoids were included with other affections of the intestinal canal. Several forms of intestinal parasites were known; amongst vermifuges were garlic, hyssop, laurel leaves, with wine and rocket seeds. Of affections of the uro-genital system mention is made of strangury, fistula, deformities of the penis, cryptorchism, hermaphroditism, pollutions and gonorrhœa. Concerning the skin diseases mentioned in the Talmud there are, despite careful description, unreconciled differences of opinion. It may be mentioned that, whilst "Saraath" is held to be a divine punishment for various forms of vice, an ætiological responsibility is sought for other cutaneous affections in poverty of nourishment, improper care of the skin, etc. Two forms of "leprosy" are distinguished according to whether the spots appear shining white or dull. The segregation of lepers was the rule, but, in comparison with Biblical times, a certain amount of laxity is noticeable, at any rate, the leper was allowed to visit the schools, remaining in a space separated from others by a high wall. From insanity in the strict sense of the term weak-mindedness, confusion and disturbance of consciousness in the course of acute disease were distinguished and the periodic character of psychoses was recognised. An interesting sentence is the following: "No man is guilty of misconduct unless the seed of insanity is in his mind." Nothing is said as to the treatment of the insane.

SURGERY

Amongst surgical instruments were a large and small knife, trephine, lancet, and "the Nail" (for blood-letting), cupping-glasses, etc. When performing an operation the surgeon wore a leather apron; for severe operations the patient was given a preliminary sleeping-draught. In the treatment of wounds and ulcers oil and warm water, balsam, compresses of vinegar

and wine were employed; in certain cases the wounds were cauterised; poisoned wounds were sucked. The wounded were always prescribed a definite diet. An important direction is that given against touching the wounds because "the hand causes inflammation." Abscesses were incised or extirpated. Amongst operations are mentioned amputation, trephining, operations upon the male generative organs, an abdominal operation for the removal of excessive fat, formation of an artificial anus in atresia ani. The statement is made in one place that extirpation of the spleen is not fatal.

OBSTETRICS AND GYNÆCOLOGY

The designations of the individual parts of the female genitals are not to be recognised beyond *cavil*, but the vagina was undoubtedly differentiated from the uterus. Examinations were as a rule undertaken by the women themselves or by other women, who then reported to the physician; in discussions upon hæmorrhage mention is made of the speculum (a tube which contained a stem tipped with tow or a leaden tube, the orifice of which was bent inwards). The physician was only summoned to labours when artificial help was urgently needed. Parentage and mode of life influence the onset of puberty—most frequent in the 12th year. The normal duration of menstruation is 7 days, and this recurs at intervals of 30 days; it is indicated by yawning, sneezing, pain around the navel, shivering fits, etc. Cohabitation with a menstruating woman was strictly forbidden, or with one bleeding in any way from the "source of blood"—the uterus; a bath was prescribed for a woman losing blood in any fashion. For purposes of ritual the diagnosis of the origin of blood, whether from the uterus or not, was of great moment, and many experts appear to have acquired great skill therein. With the commencement of pregnancy the menses cease, the blood being converted into milk, but the cessation is not invariable. Version of the child occurs immediately before birth; head presentation was the only one considered normal. Midwives probably used oil to lubricate the maternal passages. The stool of delivery was undoubtedly in use. Lying-in women were held unclean for 40 days after the birth of a boy, for 60 days after birth of a girl. Resumption of marital relationship had to be preceded by a ritual bath. Under certain conditions embryotomy could be performed, provided that no considerable proportion of the child was already born. Post-mortem Cæsarean section was performed even on the Sabbath; mention is made of an operation which may have been ante-mortem Cæsarean section or operation for extra-uterine pregnancy. There is, however, no certain proof that such an operation was ever actually performed in Talmudic times, all that is certain is that delivery with happy results for mother and child by other than the normal channel was known.

CARE OF THE NEW-BORN INFANT

Signs of maturity are fully-developed hair and nails. Immediately after birth, or at most after 24 hours, the child was put to the breast; suckling was considered a duty on the part of the mother, whose place could only very exceptionally be taken by a wet-nurse. Suckling was usually prolonged for 24 months.

MEDICINE IN THE MIDDLE AGES

INTRODUCTORY

UPON the centuries of decadence in ancient medicine followed a period of a thousand years in which careful investigation shows but a slight advance in medical science, and that only in certain individual branches; the impression given as a whole is that of barren stagnation.

The well-spring of Greek medical art never entirely failed, however, although it became troubled and temporarily choked.

Whilst the West depended upon the scanty fragments of ancient literature, and medical art in its barbarous surroundings was forced to seek an asylum in the monasteries, the legacy of culture passed to the Eastern Roman Empire, and Byzantine medicine became heir to Græco-Roman traditions. But this continuity was not progress. More concerned to maintain the intact form than to winnow the intellectual wheat from the chaff, the Byzantines, in the haughty self-reliance of Hellenism, presuming upon the possession of tradition and averse from every innovation, allowed medicine to lie fallow. They were zealous treasurers, who guarded heir-looms against better times and for other nations, but they were unable to turn their inheritance to good account, far less to add to it.

From this important but short-lived branch of Hellenic medicine sprang, by a circuitous route *via* Syria, Persia and Egypt, the medical art of the Arabs which, whilst far more instinct with life and open to fresh impressions, was yet in its essence a slavish copy of Galenism. It contained within itself many germs of hopeful augury for the future, but its chief historical interest lies in the fact that it introduced, by a collateral path, Greek science and art to the West, although in bizarre and fantastic distortion, whilst it provided, in conjunction with scholasticism, a scientific foundation for Western medicine.

In Byzantine, in Arabic, in scholastic medicine, a tinselled effigy of learning took the place of the true Hippocratic art.

The light of Hippocratism was extinguished, or at the best burnt but dimly in hidden places. Not till the end of this era was it rekindled by the infusion into decadent Byzantium of the true antique spirit, when, untrammelled by the boundaries of home and unhindered by the restrictions of nationality, it illumined the entire world.

BYZANTINE MEDICINE

"Was du ererbt von deinen Vätern hast,
Erwirb es, um es zu besitzen."—GOETHE.

By the dismemberment of the Western Roman Empire occidental civilisation suffered irreparable loss. Masterpieces of art and treasures of literature perished alike at the hands of the destroyer; the refinements of life disappeared under a rule of brute force; the aboriginal conquerors possessed no bond of union with the glorious past; war's alarms stultified every intellectual movement, and the Church alone, in her own fashion, prevented the complete wreck of ancient culture. Only by slow degrees did any improvement manifest itself; from small beginnings rose fresh manifestations of independent mental activity, but it was a thousand years before the inhabitants of the West regained the level from which they had sunk after the second century.

The tide of intellectual life ebbed from the West, and Byzantium remained the stronghold of culture till it, in its turn, went down before the vigour of the eastern races.

The predominance of the Byzantines in politics and civilisation was founded upon an unbroken connection with the Græco-Roman past. They inherited directly and without exertion, as their legitimate right, what other nations were compelled to acquire laboriously and by slow degrees. Under the shelter of the great traditions of the Imperium Romanum their government was founded upon the Roman administrative, legal and military systems, and they had at their disposal all the technical resources of the Imperial era. This broad historical basis maintained the stability of the heterogeneous Eastern Empire amidst the migrations of the Germanic, Slav and Hun nations and ensured it an astonishing power of resistance in the exhausting wars with the Persians and the Moslem, although the population was bound together in an artificial unity rather than by true patriotism, by well-ordered centralisation, by common language and a common church. Scientific endeavour kept in close touch with ancient literature, the influence of which in the promotion of education and culture preserved intellectual life, despite the paralysing influence of foreign and domestic

dissensions, from oft-threatened extinction, sparks of Greek thought ever springing anew from the ashes. Quite spontaneously antiquity offered itself to art as the national model, adaptable alike to Christianity striving after material expression, and to the prevailing orientalism in daily life, in court and ritual observances, and in dress.

Just as the eastern Roman hegemony, which at first made a strong bid for a world-dominion, was comparatively soon checked in its striving after expansion and was forced to take up an increasingly inefficient defensive attitude, so Byzantine culture after a short era of prosperity lost its creative power, which no breadth of development can replace, and fell victim to a premature senility manifesting itself, as with the ancient oriental nations, in an obstinate adherence to stereotyped formulæ, in timid aversion from the new and the strange, in want of adaptability to altered surroundings.

Favourable conditions for a free, progressive cultural development were naturally lacking in an empire beset by foes from without, and unsettled from within by religious strife and intolerance, palace conspiracies, dynastic changes, feminine intrigue, and nepotism, and whose subjects groaned under the combined Imperial and Papal yokes. Apart from this the early enervation of Byzantine intellectual life was traceable to the very cause which so greatly assisted its early advancement, to its heritage. Dazzled by the splendour of their birthright the Byzantines lacked both inclination and capacity for original achievement.

Even in the later centuries of Imperial Rome the prevailing intellectual depression had led to the abandonment of all hopes of surpassing the existing level of civilisation by reconsideration of fundamentals and addition of fresh impulses. Classic antiquity was held to be an inexhaustible quarry, and the task of the present as of the future appeared to consist solely in the collection, sifting, elucidation and elaboration of the materials of knowledge bequeathed by the past. The Church, which sought to turn men's minds away from nature and life towards the transcendental, and wished to establish universal canonical authority, warmly supported this view.

The Byzantines merely followed the downward path. Surfeited with tradition, which made modes of thought appear inevitable because customary, filled as a nation with an overweening self-conceit fed by the glories of the Græco-Roman past, they neither could nor would destroy the historic bridge nor replace the crumbling ruin with a new edifice. It lay outside the sphere of their interests to enter into that conscious emulation of antiquity which, emphasising the growing contrast between past and present, and eliminating the obsolete and the inert, is the essence of mental cultivation. Forgetting that it was the free development of the national spirit

which constituted the greatness of the past, they went so far as to smother its liveliest expression by denying, in their rigid adherence to Attic speech, all part in literature to the language of the people. The more incapable did the Byzantines become of grasping the spirit, the more tenaciously did they cling to the letter—a reflection of the mania for titles and ceremonies in political life—and thus they dragged the inanimate mechanism, the dry bones of antiquity through a thousand years, instead of erecting a new edifice upon the foundations of ancient culture.

As in life, so in letters, outward form and attractive appearance weighed most heavily in the scales and the disparity between bombastic rhetoric and dialectic juggling on the one hand and the intrinsic barrenness of these on the other, imparted to the literature of the Byzantines those characteristics of formality, artificiality and pharisaic insincerity which have become proverbial. No real advance could be made where there was no infusion of fresh elements, where boundless respect for ancient authorities quenched independent criticism, fettered the free flow of thought and discouraged original endeavour. Art alone, through the inspiration of Christianity, developed a new style, which satisfied the oriental love of magnificence, whilst technical skill made progress to meet the pressing demands of the times. But the track of antiquity was a broad one, and tradition offered the journeyman a wide scope in abstraction, elucidation and encyclopædic embellishment. Aided by enlightened rulers, having the resources of well-stored libraries at their disposal, the literary activity of the Byzantines was exceptionally many-sided, a noteworthy fact being that amongst the authors there was a predominance of educated laymen, although theological questions were under constant discussion—therein contrasting with the West, where, almost exclusively, monks wrote for monks. The favourite subjects, many of which were most adequately treated, were theology, jurisprudence, philology, archæology, history, military science and, in the last centuries, as Greek knowledge was reintroduced by the Persians and Arabs, also mathematics, and astronomy, although without the production of any truly original creations. Where, however, the fetters of tradition were not binding, where unbiassed observation, independent criticism, feeling and imagination were in question, the pedantry of the Byzantines missed its mark entirely. Thus it was that they contributed nothing to natural science, that their philosophy was no better than a form, and that their poetry, apart from that of the Church and people, was but a still-birth. As always in time of intellectual depression, individual impulse found its refuge in the obscurity of mysticism; astrology and alchemy flourished in company with every species of super-

stitution. Creative art, since it constituted the expression of the very essence of Byzantinism, the heart of the new life, necessarily declined to the level of the typical, the stereotyped, so soon as a fresh individuality of style had been evolved; skilful representation of conventional forms and grandiose display constituted the summit of artistic endeavour, the results of which were artificial and mechanical. This tendency brought architecture to the technical perfection of the Hagia Sofia with its marvellous combination of domes, and brought into being wonderful minute art-work, whilst it restricted sculpture to relief and painting to mosaic, depriving the latter of any lifelike qualities. The proof of this is to be seen in the long-drawn figures upon a golden background, meritorious in colour, but unspeakably stiff and expressionless.

Fuller and more detailed study reveals indeed the fact that in the course of Byzantine civilisation phases of advance, of stagnation and of retrogression followed one another, whilst from time to time the spell was broken by great outstanding individualities, pioneers in learning, but no true organic development can be said to have occurred. The importance of the Byzantines in the world's history lies less in the recasting than in the mechanical preservation of ancient thought.

Medicine falls into line with the conditions of culture in general, its keynote being persistence, whilst only scattered traces are found of any originative capacity. Byzantine medical literature is in its substance an anthology from the classic writings, culminating in encyclopædic compilations which differ from one another less in contents than in exhaustiveness and greater or less independence of criticism. From the ranks of industrious compilers and learned expositors it is only exceptionally that any genuine observer stands out; the overwhelming majority looked upon the doctrines of the ancients as unassailable canon in which no important changes could be made. Nevertheless the Byzantine epoch possesses great importance for medicine, since it rescued the achievements of antiquity from oblivion and maintained the continuity of tradition until the Greek healing art could be transplanted into a soil more favourable to its further development.

The phases of advance and retrogression in Byzantine civilisation did not entirely fail to leave their impress upon medical literature, but the influence was hardly a far-reaching one, since medical art was little affected by the specifically Byzantine intellectual life, its stimuli being derived, not from the Academy in Constantinople, but from those places which were still under the guidance of the true spirit of antiquity. Thus the first real gap in continuity, the dividing line between two clearly differen-

tiated periods of Byzantine medical literature, was effected by the conquest of Alexandria by the Arabs (642), which robbed the Hellenic world of its most important medical school.

The former of these two periods coincides with the Early Byzantine era, *i.e.* with the time when the ancient Græco-Roman world had at last, after protracted resistance, succumbed to the growing strength of the mediæval Byzantine Christian spirit. Since the latter was incapable of contributing to its advance, scientific medicine profited by the general upheavals of the age solely through the survival of ancient tradition.

The tendency towards finality in their summaries which is peculiar to the Early Byzantine era, and which in the realm of art found its most perfect expression in the domed architecture of the Hagia Sofia, in the field of knowledge in the codification of the law, also influenced medical literature, without entirely suppressing the impulse towards individual observation or the spirit of independent criticism. The encyclopædia of Oreibasios served as a model, but the same goal was aimed at with greater independence and directness. Galen was of great, but not of paramount, importance; the other masters of antiquity held their own beside him and, although no one dared to attack the theoretical doctrines of the Pergamene, in practical matters he was not always followed without question.

This epoch is represented by three authors, who united in very unequal degree tradition with personal opinion and independence, *viz.* Aëtios, Alexander of Tralles and Paulos of Aegina.

Aëtios was the least distinguished of these; his "Tetrabiblon," which deals with the entire subject of medicine and is arranged in a most practical manner, betrays here and there the rich experience and independent conceptions of an intellectually gifted practitioner, but for the most part he draws his inspiration slavishly from the hackneyed sources.

In pleasing contrast with Aëtios stands his younger contemporary Alexander of Tralles, whose twelve books upon pathology and the therapeutics of internal diseases, in spite of the most careful consideration of antecedent literature, never lack fresh observation, clear conceptions and independent judgment. In their contents and lofty style, indeed, they are vividly reminiscent of ancient medical literature in its prime; it is the genuine Hippocratic spirit which speaks in these works—heard for the last time before a long period of silence.

The comparatively short but nevertheless comprehensive compendium of Paulos of Aegina, consisting of seven volumes, is also, as the author himself admits in the preface, essentially nothing but an extract from the earlier authorities, including, however, a mass of original additions, taken

from active practice, the independence of the author being notably shown in the sixth book, which gives an admirable description of surgery. These three chief representatives of Early Byzantine medicine, who have inherited something of the spirit of antiquity, possess high historico-literary value. Not only do they afford us a vivid insight into Græco-Roman medicine, where the loss of the original writings left gaps not otherwise to be filled, but, Alexander and Paulos in particular, they exercised an important influence upon the development of science outside Greece.

The remaining legacies of the literature of this era consist of exegeses upon the Hippocratic and Galenic writings, compilations mainly from Galen, hygienic and dietetic treatises. The most interesting are the several works of "Theophilus," which bear witness to an increasing predilection for minute examination of the pulse and uroscopy, and which treat the doctrine of the structure and functions of the body from the point of view of *a priori* teleology under religious influence. One phenomenon is manifested therein which gives rise to disturbing reflections, viz. that (in contrast with the historians Enagrios, Procopios and Agathias) no single medical author makes mention of the severe pestilence, claiming innumerable victims, which, in the time of Justinian, ravaged the Byzantine Empire.

The zeal of eminent physicians doubtless furthered specialised pathology and maintained surgical technique on a high level—general doctrines of disease, however, were denied any real progress by the complete stagnation of anatomico-physiological research; iatrosophistical speculation did not afford even an apparent substitute, since its poverty of ideas compelled it ever to revolve within the limits set by antiquity.

The second main period, which dates from the fall of the Alexandrian school, was subject to no happy star. Medicine suffered severely in the phase of cultural decline without participating to the same degree as other branches of science in the favourable influences of the stages of rehabilitation. Examination of the extant medical literature shows a dead level of attainment with few and unimportant exceptions.

Corresponding with the low degree of culture during the Iconoclast troubles there is in medical literature a hiatus extending from the middle of the seventh to the ninth century, at the most filled by the teleological treatise of Meletios upon the human frame (written in the style of Theophilus), and by formularies preserved in manuscript, or popular medical writings, didactic poems, etc. The ninth and tenth centuries are represented by the compendia of the iatrosophist Leon and of Theophanes Nonnos. It was not until the eleventh century that a more prolific literary activity made itself once more felt. Evidence of this is furnished par-

ticularly by the encyclopædic effusions, imbued with natural philosophy, of the erudite Michael Psellos and his imitator Simeon Seth, by the surgical compilation of Nicetas and the pharmacopeia of Stephanos Magnetes. The dominion of the Western Emperors, which exercised so momentous an influence upon culture, is marked in medical literature by a later hiatus ; not till the second half of the thirteenth century do we come to the voluminous formulary of Nicholaos Myrepsos, which acquired a great value for the dispensaries of the West, and to the monograph upon gout of Demetrios Pepagomenos, the outcome of keen observation. In medicine, as in other subjects, Hellenism makes a worthy exit ; Byzantine medicine comes to a brilliant end with the works of Joannes Actuarius upon diagnosis and therapeutics, upon uroscopy, upon psychology and psycho-pathology. A writer of nice perceptions, well grounded in classic literature, versed in philosophy ; a physician endowed with keen powers of observation and sound judgment, he was far in advance of his age and environment and addressed himself to posterity.

What has been said above holds true also of this second epoch of Byzantine medicine, viz. that, whilst the knowledge of individual diseases was extended, the ancient principles of general pathology remained unshaken. Repressed energies found an outlet in the elaboration of a highly differentiated pulse-lore and in the fantasies of uroscopy, both of which were treated in monographs. It is characteristic of the later centuries that, under the gradually spreading influence of cultural relationships with the Asiatic East, Persian, Arabian and Indian drugs found a place in the pharmacopeia, and that Arabic or Persian works were even translated into Greek.

What the Byzantines borrowed from the East is in no way to be compared with the bountiful store of knowledge which accrued *via* Syria and, principally, through the agency of the heterodox sect of the Nestorians. It may be accepted as certain that mediæval western medicine was not uninfluenced thereby, although the fact is so far insusceptible of direct proof, nor can the extent of this influence be estimated.

In addition to scientific medicine, medical folklore flourished in Byzantium, and more than ever did medical superstition spread among all classes, deriving constant reinforcement from the fertile soil of primæval oriental mysticism. Yielding to the influence of the spirit of the age, even prominent medical authors did not hesitate warmly to recommend charms, incantations or amulets in tones of full conviction or at least as a matter of policy.

Aëtios communicates with conviction a number of magical methods and formulæ, but more striking still is the recognition of supernatural therapy by the intellectual and enlightened

Alexander of Tralles. The latter refers in exculpation to Galen, who was originally sceptical, but who later had considerably modified his attitude : he expresses the opinion that an intelligent physician should neglect no remedy, and should be conversant with the secret forces of nature as well as with scientific and recognised methods. That Alexander dealt at least tentatively with suggestion as a remedial measure seems to be indicated in the following passage, concerning the treatment of podagra : " Since there are many men who are neither able to order their lives aright, nor to withstand the effects of drugs, and who thus compel us to make use of magic and charms, I will deal with these ; for a capable physician should be familiar with all methods, so as to be able to assist the patient in the most diverse ways."

Into the conditions of instruction and the standing of the profession the scanty information available gives us little insight, but we may conclude upon analogy that in general the essential conditions of later Roman times persisted.

The guardianship of the State was principally directed towards improvement of the sanitary condition of the army and the provision of infirmaries, which latter remained unproductive for research purposes, as the physicians within their walls were not accorded the necessary scope for their activities and, in place of scientific endeavour, bigotry, superstition and dilettantism held their sway.

In Byzantine times physicians were specially appointed to ships. The cavalry were accompanied in the field by a medical corps, whose duty it was to bring in the severely wounded and render first aid ; they carried water-bottles with them.

Byzantine historians mention here and there the names of court physicians, but none of these have succeeded in making their mark upon the history of science.

Amongst the most celebrated infirmaries in Constantinople were that of St. Samson, situated close to St. Sofia, and greatly enlarged by Justinian I., the " Orphanotropheion," built by Alexis I. (1081-1118), which enjoyed an extraordinarily wide repute, and the Hospital of the Forty Martyrs, founded by Isaac Angelos (1185-1195). There were, in addition, dating from the fifth and sixth centuries, leper-houses, foundling hospitals and homes for fallen women (the first was founded by Justinian and his wife Theodora). In Byzantine infirmaries monks and pious laymen played the chief part ; many contemporary formularies now in existence were used by them. Interest in medicine extended into the highest circles. The celebrated Anna Comnena was learned in medical matters and even presided over the consultations of the court physicians upon the last illness of the Emperor Alexius I. The Emperor Manuel (1143-1180) prescribed medicinal drinks and salves for use in the infirmaries and in severe cases even treated patients himself.

BYZANTINE MEDICAL LITERATURE

SIXTH CENTURY AUTHORS

AETIOS was born at the beginning of the sixth century at Amida in Mesopotamia, received his medical education in Alexandria and lived in his prime at the Byzantine Imperial Court with the title of comes obsequii. He bequeathed a compilation consisting of sixteen books (βιβλία ἱατρικὰ ἐκκαίδεκα) usually referred to as Tetrabiblon, from its division (customary in certain manuscripts) into four τετράβιβλοι to every four λόγοι.

INTERNAL MEDICINE.—His doctrines upon fever are mainly derived from Galen, the statement, however, on the part of Aëtios, that “erysipelatous” inflammation of the intestines is capable of causing various fevers is original; the treatment (antipyretic measures, drinking cold water) shows marked divergence from tradition. If inflammation attacks the stomach, lipyria ensues, a condition in which the internal parts are scorched with heat whilst the external freeze. If the starting-point is in the liver “typhus fever” arises; if in the lungs, ague. Aëtios also claims the credit of having described several varieties of cerebral affections, *e.g.* “erysipelatous” encephalitis and an encephalitis of children; apoplexy is also well described and personal experience is revealed in his account of leprosy, gastric affections and the treatment of pleuritis. A remarkable description is that of an epidemic throat complaint, in which paralysis of the soft palate may occur, and which is doubtless identical with diphtheria. “In children the complaint is developed almost constantly from previously existing aphthæ. The ulcers are at times white and patchy, at others of an ashen-grey colour, or they resemble the scabs caused by use of the cautery. The patient is seized with dryness of the throat, to which is added great difficulty in breathing, particularly when redness is seen under the chin, or if, after the acute stage is over, noma and gangrene ensue . . . care should also be taken of the fever, which usually sets in with severity. . . . In many cases the uvula is destroyed and, if after a long time the ulceration stops and cicatrisation begins, children speak indistinctly and in swallowing fluid returns through the nose. Thus I have seen a girl die after forty days, who was already in convalescence. Most cases, however, are in danger up till the seventh day. . . .”

SURGERY.—Aëtios is for the most part an adherent of the best of his predecessors and adduces many important fragments from their works. His teaching upon wounds and treatment of ulcers comes from Galen. Book XIV. Chap. 51 contains an extract from Ruphos upon hæmorrhage and its arrest (digital pressure, compression by bandage, cold, astringents, corrosives, torsion, ligature, complete section of incised vessels), as well as upon the origin of traumatic aneurysm from arterial injury. Chapters upon ileus (with which is included strangulated hernia), hepatic abscess, treatment of sciatica and coxalgia with actual cautery and moxa, are derived from Archigenes. The following paragraphs are based on Leonides: incision of tonsillar abscesses, pathology and treatment of glandular tumours of the neck, of

cystic tumours, of lipomata, use of the actual cautery in treatment of prolapsus ani; operation for fistula, treatment of fissures of the prepuce, treatment of hydrocele (cauterisation by repeated application of strips of plaster to the scrotum and opening the tunica vaginalis after it is laid bare), herniæ, etc. (hernia the result, partly of stretching, partly of rupture of peritoneum; technique of reduction, bandage, hernia-plaster). Philagrios is the originator of fragments upon the removal of impacted stones in the urethra by urethrotomy, and upon ganglion; Ruphos and Poseidonios of those upon lyssa. Of the remaining contents the following points deserve mention. A good description of tonsillotomy. Removal of foreign bodies from the œsophagus: the patient is made to swallow a sponge moistened with turpentine and fastened to a strong thread in order to catch the foreign body so that it may be withdrawn. Detailed descriptions concerning the treatment of bites and insect stings. Operation upon hæmorrhoidal tumours by ligature and abscission. Treatment of malignant ulceration of the rectum. Inflammation and ulcers of the male genitals, of varices. Aëtios was generally opposed to operation upon aneurysms, with exception of traumatic aneurysm in the bend of the elbow, and he describes the following method: first of all, above the aneurysm, three to four inches below the axilla, a double ligature is placed around the exposed artery, the latter is cut through between the ligatures, the aneurysm is then incised and emptied, the injured part being enclosed between two ligatures and extirpated.

OBSTETRICS AND GYNÆCOLOGY.—Anatomical descriptions are based largely, though not exclusively, upon Soranos. Birth takes place owing to the membranes becoming too small and the blood-supply insufficient, the child then tearing the membranes and emerging by means of active movements. Pregnancy and dietetics of pregnant women are carefully considered; signs indicating approaching delivery are: reduction in size of the upper abdomen, frequency of micturition, increased mucous secretion, greater accessibility of the uterus to the examining finger; if downward pressure does not occur with labour pains, swelling of the neck results. Artificial abortion is induced in those cases where labour at the normal time would be dangerous to the mother, the most favourable moment is the third month; an indication of approaching abortion is the discharge of watery or blood-stained fluid. Amongst the means of procuring expulsion of a dead embryo is the introduction of dry sponges or papyri. In the 22nd chapter the following remarkable statement occurs upon the causes of dystocia: "Difficulties also occur in delivery if the bones of the pubic region have become firmly united (ossification of symphysis pubis), so that during labour they cannot become separated, for in women these bones are not, as in men, firmly united but held together by a strong ligament. Difficulties may also arise if the sacrum is too concave and the uterus thereby pushed to one side." According to this skeletal anomalies are cited as obstacles to delivery. These were first considered by Herophilos and, following him, by Soranos, but at the same time adherence is given to Soranos' erroneous doctrine of the separation of the pelvic bones *intra partum*.

Chaps. 23 and 24 are, according to Aëtios, taken from Philumenos, and deal with extraction of the fœtus, embryotomy, embryulcia and removal of the placenta. Examination of the parturient woman (*διδασκαλία*), in order to ascertain the cause of obstruction, removal of growths, incision of resistant membranes are mentioned: if the head has become tightly wedged, the child is to be turned by the feet and so brought to light." The indications and technique for perforation, cephalotripsy, decapitation and dismemberment are given. In removal of the placenta the left hand is inserted through the open os uteri, whereby the separated placenta is easily removed; if adherent, direct traction downward is to be avoided, so that prolapse of the uterus may not occur. In order to promote dilatation of the closed os uteri oily injections, gradual stretching with the left hand, emmenagogues, sitz-baths, etc., are to be used. Other remarkable points are contained in the directions concerning differential diagnosis of malignant ulcers, operation for carcinoma mammae (after Archigenes, Leonides), for atresia of uterus and vagina, calculus of the bladder (vestibular incision), hydrocele muliebris (excision of a piece of the cyst wall), inguinal hernia (if bandages fail, radical

cure by ligature and suture of the sac), vulvar varices (ligature and extirpation), amputation of the clitoris, vesicular mole (first description).

OPHTHALMOLOGY.—The treatise upon this subject is, according to expert opinion, the best and most exhaustive of antiquity (except for the lack of any description of cataract extraction). Aëtios, indeed, relies upon the entire antecedent literature upon the subject, as known to him, but there are not wanting numerous individual observations, particularly in the matter of therapeutics. He is familiar with sixty-one affections of the eye and already, to a certain extent, observes an anatomical basis in classification. "The so-called intrinsic inflammation of the eye, chemosis, irritation of the conjunctiva, swelling, ecchymosis are diseases of the conjunctiva. This may also ulcerate and may be subject to carbuncle and cancer; dry catarrh of conjunctivæ and lid-margins is a complaint common to lids and eyes themselves. On the outer surface of the lids occur blisters, sebaceous cysts; on the under surface occur roughnesses with their further consequences (corneal and herpetic lesions), stytes, chalk-stones, symblepharon and closure of lids; lagophthalmia is that condition in which the upper lid is retracted so that it does not cover the eyeball. On the cornea occur nebulæ and white patches, superficial and marginal ulcers, abscess, ulcers, broad and shallow or deep, perforation, prolapse, hypopyon, pustules, etc.: affections of the eyes are: prolapse, staphyloma, grape-kernels; mydriasis, myosis, synchysis, irregularity of pupils. Increase or opacity of the aqueous humour diminishes visual acuity, and its diminution causes shrinking of the lens. This is called glaucosis, and is nothing but marked desiccation of the lens. Amaurosis is a blocking of the optic nerve so that the patient is unable to see anything, although the pupils appear clear. Night-blindness is also caused by damage to the visual apparatus without anything being visible to account for it." In his treatise Aëtios quotes important fragments from Demosthenes (upon cancerous ulceration, abscesses, ocular weakness, amaurosis, cataract, ectropion, lagophthalmia), from Severos (ulceration of the eyes, foreign bodies, carbuncle of the lid, treatment of purulent conjunctivitis in the newly born,¹ trachoma, trichiasis, entropion), from Antyllos operation for ectropion.

DISEASES OF NOSE AND MOUTH.—Many affections coming under this heading are described and a voluminous therapy recommended, but of surgical interference there is no word. Extraction of teeth even is not mentioned by Aëtios.

Alexander of Tralles (Lydia), a member of a highly gifted family,² was born in 525 A.D. and received his first medical education with his father, the busy physician Stephanos. He later travelled in Italy, Spain, Gaul and North Africa, obtaining practical experience everywhere, and finally settled for good in Rome; there he worked, possibly also as an official teacher and physician, up to a green old age. Alexander presented the scientific results of his long and conscientious medical labours in his masterpiece, part of which treats of the pathology and therapeutics of internal diseases in the shape of academic discourses in homely, clear and unpretentious manner. This work, indeed, constitutes a refreshing oasis in the desert of Byzantine literature, it is in places even reminiscent of the unbiassed power of observation of an Hippocrates, of the lively, clear

¹ Soranos recommended that, immediately after birth, oil should be dropped in the eyes, in order to avoid ophthalmic affections.

² Of the four elder brothers of Alexander, Anthemios acquired undying fame as builder of Hagia Sofia, and was the foremost mathematician and physicist of his time; Metrodoros distinguished himself as a grammarian, Olympios as a jurist, Dioscoros as a physician.

descriptions of an Aretaios ; although the author makes careful use of the literature, his own personality never disappears, and, although in matters of theory he avows himself a disciple of Galen, he yet maintains in practical questions an unshaken independence. Raised above the blind belief in authority of the age, Alexander does not hesitate to express individual opinions founded upon genuine experience.¹ Herein only is he true to his era, that, led by a humanity which left no stone unturned in his patients' interest, he recommends methods of superstition when rational remedies have failed—provided that the patients wished for magical cures.

The writings of Alexander exercised considerable influence upon the development of medicine ; they were not only much used by all later Byzantines, but, in the shape of translations, penetrated both east and west ; they stood, even in the most unenlightened times, as worthy models of genuine medical observation and criticism.

GENERAL PATHOLOGY.—Exciting causes of disease, evidenced by pathological changes, are sharply distinguished from predisposing causes, *e.g.* influence of temperature, errors of diet, etc. In the causation of disease morbid humours (doctrine of dyscrasiæ) are taken into account as well as disturbances of function of the vital forces. The composition of the morbid humours determines the character of the disease. Affections are local and general, primary and secondary ; symptoms are divided into essential and accidental ; coction shows itself mainly through the dark colour of the urine. Inflammation is conditioned by elevation of temperature, which calls forth increased flow of blood, phlegm, yellow or black bile ; pus, which may be known by its colour, smell on burning, and from the fact that, unlike phlegm, it mixes with water instead of falling to the bottom, also results from access of morbid humours. Fever arises from abnormal increase of inherent warmth, either pneumonia, fluid or solid parts being attacked.

GENERAL THERAPEUTICS.—Treatment is evolved from diagnosis, the first endeavour being to eliminate the cause of disease. The guiding principle is that of "*contraria contrariis*," the natural healing powers being observed and the critical evacuations assisted. "The duty of the physician is to cool the warm, to warm the cool, to dry the moist and to moisten the dry." Drastic cures and over-interference are to be avoided. "Unfortunately there are many who consider those physicians who take pleasure in burning and cutting more competent than those who attempt to cure by a rational system of diet." The choice of drugs is guided by reason and still more by experiment ; complex remedies serve to reconcile conflicting indications. Venesection is undertaken according to tradition at the well-known sites of election, but the spot is immaterial since the withdrawal of blood takes effect upon the entire mass.

¹ One passage is noteworthy in which Alexander blames Galen on account of his therapeutics and excuses himself in the following manner : "Here may be applied the saying of Galen concerning Archigenes : 'He was a man, and it is therefore difficult to assume that he never made mistakes, since he must have been ignorant of many things, have misinterpreted others and described them superficially.' Yet would I not have dared to say this of a man who stood so high in science, if truth had not inspired me with confidence and if I had not held silence to be a sin. For if a physician form an opinion and fail to express it he does a great wrong, behaves wantonly, and by his silence is much to blame. Herein one should follow the principle which, as he tells us, Aristotle has laid down : 'I love Plato, but I also love truth, and so, if choice must be made between them, I give preference to truth.'"

SPECIALISED PATHOLOGY AND THERAPEUTICS

NERVOUS DISEASES.—Headache may result from local morbidity of humours, or may arise in the course of affections of stomach, liver, spleen, or in fevers, from excessive consumption of wine, or mechanical irritation of the skull. Chronic headache develops from general plethora, localised anomalies of the juices, heating of the bile, digestive disturbances, insomnia and sorrow. As a symptom of inflammation of the brain, headache is often a forerunner of convulsions and delirium, even of sudden death. Hemicrania occurs primarily in the head when the morbid humours collect there, become congealed and dissipate into vapours, or secondarily in abdominal affections. Apoplexy consists in arrest of the powers of movement and sensation. Paralyses depend upon stagnation and obstruction (through the humours) either in the brain or in individual nerves. If the brain is implicated hemiplegia or facial paralysis is to be expected. Treatment: removal of the humoral obstruction by means of purgatives, venesection, rubbing, baths; local irritation of the paralysed parts by application of leeches, scarification, mustard plaster, pitch-plaster, aromatic compress, fumigations, etc. Epilepsy is due to obstruction of the brain by phlegm and black bile; there are three forms of this disease according to whether it originates in the head, stomach or other part of the body.

PSYCHOSES.—"Phrenitis" was held to be an inflammation of the brain and its coverings, caused by bile. Treatment was begun by a venesection, followed by sedative applications to the head (e.g. a mixture of vinegar and oil of roses), narcotics ("for sleep is the one and only remedy for insanity"), eventually lukewarm baths, rubbing; food to consist of demulcent drinks and soups; quiet enjoined. "Lethargy," a cerebral disorder due to accumulation of phlegm in the brain, ushered in by weakness and somnolence, demands cooling and stimulating measures, the internal and external use of castoreum is particularly indicated. "Carus" calls for similar treatment; the seat of this disease is in the front of the brain. Melancholia, according to Aëtios, included many forms of psychic disturbance, the cause of the disease being a faulty condition of the blood.

DISEASES OF THE RESPIRATORY SYSTEM.—Angina is to be treated with gargles (of mildly astringent vegetable juices, later of alkalies), compresses, in the plethoric also by venesection (from the sublingual or jugular veins) and purgatives. Cough may be a symptom of a variety of diseases and may arise, sometimes from one, sometimes from another organ. Treatment must be modified according to the underlying dyscrasia; the best results follow the careful use of opium preparations, fumigations and oily inunctions to the chest. In the numerous prescriptions furnished by Alexander, storax, anise, turpentine, castoreum, liquorice and sulphur are the chief ingredients. The most important diagnostic point in determining the presence of empyema is the succussion sound. "If matter be contained in the chest . . . its presence can be concluded from the fact that a noise is heard on suddenly turning the patient." In the treatment of phthisis suitable nourishment, free consumption of milk, medicinal springs, change of air and sea-voyages were recommended. Pleuritis—inflammation of the membrane lining the ribs, to be distinguished from pain in the side—is associated with high fever, stabbing pain, difficulty in breathing and cough. The intensity of the fever in this affection is due to the proximity of the heart. The colour of the sputum is a guide to the nature of the morbid humours; red colour denotes blood; golden-yellow, yellow bile; white, phlegm; black, black bile. In the differential diagnosis from diseases of the liver with similar symptoms it is to be noted that in the latter the stabbing character of the pain, the hardness of the pulse and the cough with abundant secretion are lacking.

DISEASES OF THE DIGESTIVE APPARATUS.—Aëtios gives a description of the symptomatology of stomach affections. Loss of appetite depends upon an excess or abnormal mixture of the humours collected in the stomach; excessive thirst is caused by dyscrasiae or by injurious juices in the stomach; vomiting by accumulation of injurious materials which may be formed

either in the entire body or in the stomach alone. The treatment recommended is, following the doctrine of crisis, a causal one; according to the indications at one time warming and drying, at another cooling and astringent, or again, stimulant or strengthening drugs are made use of, apart from evacuant measures. Alexander is the last author to give a description of the much-debated "*Morbus cardiacus*." Colic is produced by cold, thick, mucous, or by hot and bilious, humours, which accumulate in the large intestine, or it may develop secondarily from affections of neighbouring organs. The differential diagnostic characteristics of colic as distinguished from other, and especially from kidney troubles, are fully entered into. Alexander looked upon ileus as a phenomenon occurring in the course of a colic. He distinguishes four varieties of cholera, amongst which are, not only cholera nostras, but also less severe forms of intestinal affection. Dysentery, the clinical picture of which is presented with great truth to nature, may arise primarily or secondarily in the intestine. The clinical course depends on the seat of ulceration. If the upper part of the small intestine be affected, severe abdominal pain is followed after several hours by thin, membranous, bloody stools; ulceration lower down early produces evacuations with a slight admixture of pus; ulceration of the large intestine causes pain in the lower abdominal region, tenesmus and carneous stools; rectal ulceration produces only tenesmus and bloody motions. The so-called hepatic dysentery is due to weakened hepatic function, which causes diarrhoea and thus eventually predisposes to intestinal ulceration. In treatment the degree of diarrhoea and seat of ulceration are to be taken into consideration. If the ulceration is in the upper part of the intestines, remedies are to be administered by the mouth; if in the lower, through the anus. Severe diarrhoea calls for the administration of demulcent and binding decoctions, astringent vegetable extracts, opiates, pills of arsenic, sandarach, powdered galls, enemata of demulcent, astringent and narcotic substances, warming poultices, salves, plasters and inunctions. Aëtios enumerates three varieties of intestinal parasites, which are recognisable as oxyuris vermicularis, ascaris lumbricoides and tænia. The symptomatology is well described and he shows himself familiar with the migration of ascarides into the stomach. The origin of worms is attributed to the decomposition of ingested food or the putrefaction of undigested gastric juices. As vermifuges against tape- and round-worms, pomegranate blossoms and seeds, filix mas, worm-grass, the seeds of heliotropum europæum, scammony, black hellebore, hyssop, castor oil, and myrtle leaves were used. Special use was made of a decoction of artemisia maritima, coriander seeds and thyme against round-worm, and thread-worms were treated by enemata. Diseases of the liver were divided into inflammation, congestion and weakness. Dropsy was held by Aëtios to be caused by functional disturbance of the liver, whereby nutriment is converted, not into blood, but into water (ascites), phlegm (anasarca) or gas (tympanites). In ascites the fluid in the abdominal cavity moves as if in a skin when the patient changes his posture (fluctuation). In tympanites a sound like a drum is heard on tapping the abdomen (percussion). In anasarca the imprint of the finger remains on the skin.

DISEASES OF THE GENITO-URINARY SYSTEM.—Difficult and painful micturition indicates the bladder as the seat of disease; if the urine contains pus, ulceration of the bladder is present. If there is neither pain, swelling nor frequency the trouble has its seat in ureters or kidneys. Treatment: diuretic drugs, diaphoretic decoctions, free drinking of lukewarm water and wine, and warm baths. In nephritis there is an increased flow of abnormally constituted blood; if suppuration occurs fever and pain become worse, without any obvious cause, rigors and attacks of fever set in; lying on the sound side causes increased sense of weight, every movement augments the pain. The urine contains blood and pus and at times emits an evil odour. Renal calculus may be distinguished from colic in that the pain of the former is more severe, more circumscribed (chiefly in the loins) and that the urine contains a gravel-like, sandy deposit.

The last volume of Alexander's pathology is devoted exclusively to podagra. Four

varieties are distinguished according to the morbid humour causing the attack; if, for instance, it is due to bile, the joint appears reddened, but not swollen; if phlegm be the cause, heat and redness are wanting, but tension and pain are well-marked.

DISEASES OF THE EYES.—The section on ocular disease in Alexander's chief work is no more than a formulary with scanty elucidatory text. The work on ophthalmology also ascribed to Alexander is noteworthy as containing a distinction between inflammatory and simple chemosis, and two swellings of the lids, "emphysema" and oedema. Interesting remarks are found at the end of Book I. of the treatise on predisposition to ocular diseases.

Amongst other statements are the following: "Interference with visual power and glaucosis affect older people, and the blue-eyed more than those with dark eyes. . . . Mydriasis is more often found in those who have rather large and dark eyes. . . . Inflammations of the eye are apt to develop if one tries to see small objects and looks at them fixedly; so too, people who frequently bathe in the sea, who work in a smoky atmosphere or exposed to the sun and who take much salt food are prone to inflammation of the eyes. . . . Assiduous reading causes a predisposition to eye complaints. Iron-workers and carpenters readily get bad eyes; runners, on the other hand, do not."

SEVENTH CENTURY AUTHORS

Theophilus, Protospatharios (=captain of the Imperial bodyguard). In manuscripts reference is made to Theophilus, to Theophilus Monachos and Theophilus Protospatharios, which makes it likely that there were three different authors of the same name.

The treatise *περὶ τῆς τοῦ ἀνθρώπου παρασκευῆς* consists essentially of an extract from Galen's "De usu partium," devoid of all originality and more a physiological than an anatomical writing. Its underlying principle is a teleology inspired by piety.

The writing *περὶ οὔρων*, for centuries accepted as authoritative, is founded upon the Galenic theory that the urine is secreted from the inferior vena cava, although the hypothesis added that the fluid parts of the urine are already present in the portal vein and thence reach the vena cava by very fine capillary canals. The nature of the urine indicates the condition of the entire blood and also the affections of individual parts of the body.

The writing *περὶ διαχωρημάτων* is founded upon Hippocrates and Galen and is certainly from the pen of the writer upon urine; it is thus of interest as showing how Greek physicians made use of every means at their disposal which might assist in arriving at a diagnosis.

Paulos of Aegina (hence Aegineta) practised in Alexandria during the first half of the seventh century, and was highly distinguished as surgeon and obstetrician. Of his works we only know the compendium of medicine in seven books, entitled *ὑπόμνημα*, which once again epitomises clearly and succinctly the medical knowledge of antiquity. According to Arabic statements he is supposed also to have written upon diseases of women and toxicology. The esteem in which Paulos was held is evidenced by the fact that his work was translated into Arabic 200 years after his death and comparatively early into Latin.

Like Oreibasios Paulos pays some attention to pediatrics. A variety of remedies are supposed to assist dentition (*e.g.*, frequent rubbing of the gums and application of various fatty substances), after eruption of the teeth the child was given decorticated iris roots to gnaw; convulsions are treated with baths, constipation with suppositories, honey, etc. Aphthæ are divided into white, red and black, of which the last are the most dangerous.

Concerning diseases of the lungs Paulos reports that he has, on several occasions, observed the coughing up of lung-stones, is familiar with the metastasis of pus to the bladder in phthisis (tubercular cystitis), and vicarious hæmoptysis in amenorrhœa, whilst he enumerates points in differential diagnosis between muscular rheumatism and pleuritis. He directed his attention far more than most Greek physicians to diseases of the heart, although his paucity of pathological and anatomical knowledge prevented his going very far; he discusses erysipelatous inflammations of the heart, which are as dangerous as wounds, sympathetic cardiac affections in brain and gastric disease, and explains many cases of palpitation as due to plethora. Amongst diseases of the intestinal tract are mentioned gastric ulcer, gastric and dysenteric forms of lenty, and ileus, which may be caused by indigestion, obstruction, or descent of the intestine into the scrotum. In the latter case reposition and application of a bandage are recommended; there is no word of operation upon strangulated hernia. Paulos develops a noteworthy theory upon gout. According to his view, as a result of insufficient assimilative power of the various parts of the body, there is formed from superfluous food, together with indolent habits of life and frequent digestive disturbances, a morbid humour, which is first attracted by the weakened joint, but also by liver, spleen, throat, ears and teeth. The theory therefore assumes on the one hand the formation of a pathological material from metabolic changes, on the other hand the deposition of the same in "weakened" parts. "Phrenitis" he looks upon as an inflammation of the brain and meninges and sharply distinguishes it from the delirium of fever; the seat of anosmia he places in the anterior ventricles of the brain. Paulos mentions the contagiousness of leprosy and filaria medinensis, which is most prevalent in Upper Egypt and India. An entire book is devoted to poisoning from animal bites or insect stings, also from the consumption of poisonous vegetable or mineral substances.

Book VI. gives a comprehensive survey of the surgery of antiquity; although founded upon the writings of Hippocrates and Galen, of Leonides, Soranos and Antyllos, it gives throughout evidence of independent judgment and the skilled hand of the expert. Only a few extracts can be quoted here. Minute directions are given upon venesection (mainly performed on the three veins of the bend of the elbow), cupping (preferably with wide-mouthed bronze cupping instruments), scarification (with the bistoury), cauterisation (of the head in ocular inflammations, of the axilla in habitual dislocation of the shoulder-joint, of the abdominal wall in diseases of liver, spleen, stomach, etc.); of hæmostatic methods, in addition to the actual cautery, the ligature is mentioned, but not torsion. The most interesting chapter of the section upon treatment of wounds is that upon the removal of arrow-heads, since it affords a profound insight into contemporary military surgery and gives an astonishing variety of detailed directions. The teaching upon fractures and dislocations is laid down with extraordinary thoroughness, following Hippocrates, Soranos and Galen, although Paulos differs from his predecessors upon many points. Soranos distinguished eight varieties of fracture of the skull, amongst which was that by contre-coup; the last was denied by Paulos; his description of trephining also differs from the traditional one. He gives detailed descriptions of fracture of the nose, clavicle, scapula, sternum, ribs, extremities, etc., with minute directions for treatment. Herein may be seen many deviations from the methods of Hippocrates. For instance, splints are applied at the first, not, "as the ancients did it," only after a week. In reference to compound fractures it is mentioned that Hippocrates held reposition of protruding fragments to be dangerous, "yet," says Paulos, "time has shown that the method is sometimes a successful one." In opposition to Hippocrates, he advised that, in dislocation associated with wounds, reduction should be at once effected, although selection of cases is necessary.

OPERATIONS UPON THE HEAD AND NECK.—There is an excellent description of trephining, cranial injuries being special indications; Paulos did not recommend its performance in hydrencephalocele. Tonsillotomy was to be performed only after cessation of inflammation;

the instrument was the ankylotome, provided with a curved cutting edge. Warning is uttered against injury to the carotids or recurrent nerves in extirpation of glandular tumours in the neck.

OPERATIONS UPON THE THORAX.—Amputation of the hypertrophied male breast, cauterisation of carcinoma *mammæ* or extirpation of the same. In the surgical treatment of empyema Paulos hesitated at resection of the ribs or even at simple opening.

ABDOMINAL OPERATIONS.—Paracentesis in ascites is thus performed : an incision is made in the abdominal wall with the point of a fine knife, which is then pushed through the peritoneum a little higher up ; through both wounds a bronze pipe is passed, but the fluid is not completely drained away. Hæmorrhoids can be removed by being cauterised after ligature, or (following Leonides) by being compressed for some length of time with a crushing instrument and then cut off ; Paulos mentions the use of the speculum in operation for fistula. Radial operation for hernia comes under notice ; in scrotal hernia he invariably removed the testicles ! Other operations were those for hydrocele (excision of tunica vaginalis with subsequent suture), varicocele, hermaphroditism, hypospadias, phimosis and castration. Interesting descriptions are given of catheterisation and lithotomy.

OBSTETRICS AND GYNÆCOLOGY.—Cephalic version is not expressly, podalic not clearly, described, a fact that in the future, owing to Paulos' unquestioned authority, was to lead to the disappearance of these important operations from obstetrics.

OPHTHALMOLOGY.—Paulos' descriptions give a full insight into the attainments of antiquity upon this subject. His most interesting operations are those for trichiasis, ectropion, cysts, symblepharon, staphyloma and for cataract. The last operation was that of depression, not extraction.¹

OTOLOGY.—Foreign bodies were removed with hooks, pincers, shaking of the head, suction through a tube, exciting sneezing with subsequent closure of nose and mouth, as a last resource by incision behind the ear.

RHINOLOGY.—In extraction of nasal polypi the nostril is dilated with the left hand, the polypus is cut off at its base, and the instrument twisted round, when the growth is extracted by means of the spoon-shaped part of the instrument.

AUTHORS OF THE NINTH TO TWELFTH CENTURIES

The iatrosophist Leon, who lived under the Emperor Theophilos (829-842) wrote a compendium, *Σύνοψις ιατρική*, a condensed handbook of medicine in six books, which contained much that is worthy of note. The fact is especially remarkable that, in describing therapeutics, surgical matters receive considerable attention (*e.g.* operation for nasal polypi, removal of tonsils, operative cure of fistula in ano and condylomata). At the instigation of the Emperor Constantine Porphyrogenetos (912-959) Theophanes Nonnos edited a medical compendium *Ἐπιτομή τῆς ιατρικῆς ἀπάσης τέχνης*. This work is a mass of uncritically assembled extracts from older compendia.

The remarkable work upon the pulse by the monk Mercurios dates, at the earliest, from the tenth century and is characterised by extreme subtlety. The pulse is felt with four fingers of the right hand, and to each finger is conveyed information concerning diseases of different parts of the body.

The most eminent medical author of the eleventh century was Constantine (or, to give him his monastic name, Michael) Psellos, who wrote upon many subjects besides medicine. He revived Platonism, whereby he sought to free his contemporaries from the bondage of scholasticism, and he also stimulated interest in natural philosophy.

In his *Διδασκαλία παντοδαπή* a series of physiological questions is dealt with, *e.g.*

¹ Cataract was looked upon as a coagulated exudate situated in the space between iris and lens.

doctrine of temperaments, theory of vision, possibility of creating male or female infants at will.

His *περὶ λίθων δυνάμεων* discusses the healing power of stones. Agate heals epiphora, headache, dropsy, and arrests menstruation; amethyst cures dipsomania and headache; amber, urinary troubles and fever, and strengthens vision; beryl cures convulsions, ophthalmia and jaundice; diamond, fever; jasper, epilepsy.

Simeon Seth, a contemporary of Psellos, utilised the writings of the latter as a groundwork for his own effusions. His writing upon the curative properties of foods is founded, not only upon Greek precursors, but also upon Persian, Arabic and Indian materia medica, for which reason it is of great value to the student of relationships between oriental and occidental medicine. Amongst the drugs mentioned are: camphor (as an anaphrodisiac), musk, amber, cloves, nutmeg, hashish, syrups (*e.g.* of violet roots in affections of the breast), and several preparations of julep.

Dating from the end of the eleventh century is the collection of surgical writings (Hippocrates, Apollonios, Soranos, Ruphos, Galen, Oreibasios, Paulos) made by Nicetas, which was of great importance in the history of ancient surgery. A Florentine manuscript contains coloured illustrations.

AUTHORS OF THE THIRTEENTH TO FIFTEENTH CENTURIES

Demetrios Pepagomenes, court physician to the Emperor Michael VIII. Palæologos (1261-1281) wrote several monographs, of which only two have survived, one on a veterinary subject, the other on gout. The author shows himself a rational observer and careful therapist; he considers the cause of gout to lie in the retention of morbid excretions. Gout is therefore a diathesis affecting the entire body, the symptoms being explained by the determination of excretions to the weakened parts; internal organs, heart, liver and brain may also suffer. Since gout originally was caused through errors of living—the complaint may be transmitted hereditarily throughout whole families—it can only be cured by a dietetic régime which, however, as he points out, though easy to prescribe is difficult to follow.

Nicolaos Myrepsos (*μυρεψός* = unguentarius) was the author of a celebrated formulary, the *Δυναμειόν*. According to the report of a contemporary he was distinguished as a practitioner, but lacked higher education. He collected a mass of prescriptions, most of which were obtained in Alexandria, his native town, and in Italy, and published them in his old age (1270-1290) in his "Antidotarium." The formulary of Nicolaos constitutes a pharmacopeia compiled from Greek, Latin and Arabic authors.

The last prominent Byzantine writer, Joannes Actuarius, son of Zacharias (end of thirteenth and commencement of fourteenth centuries), was the author of several meritorious works which betrayed classical culture in their style and exhaustive knowledge of literature coupled with independent criticism and personal experience in their contents. The most important work, *θεραπευτικὴ μέθοδος*, shows that Joannes, led by the Hippocratic spirit, aimed at individualism in treatment, preferred, where possible, simple and mild remedies to the customary concoctions or drastic measures, and that he was able, by unbiassed observation, to make many valuable additions to the sum of clinical knowledge. His theory is essentially Galenic, but Joannes—as is best shown in his teachings on the pulse—sought to overcome the inordinate diffuseness and consequent want of clearness of the Pergamene.

He wrote a monograph in seven volumes, *περὶ οὔρων*, upon the increasingly popular subject of uroscopy, which was later accepted as authoritative and classic. In this he in no way emphasises uroscopy as a universal diagnostic method, but lays stress upon the importance of other methods of examination. His whole tendency, as shown in his most important work, is towards the school of the pneumatists; he made use of their principles, particularly in psychology and psycho-pathology (to which the philosophically educated physician was especially attracted), and the fruit of his researches in these subjects is embodied in his work in two volumes, of no little importance from a practical standpoint, *περὶ ἐνεργειῶν καὶ παθῶν τοῦ ψυχικοῦ πνεύματος καὶ τῆς κατ' αὐτὸ διαίτης*, i.e. upon the functions and disturbances of the soul-spirit and the appropriate diet.

Joannes was a herald of that renaissance which medicine was to undergo after the lapse of a few centuries.

The writing of Joannes Actuarius upon the urine shows critical and enlightened appreciation of the observations of Hippocrates and Galen and of the earlier labours of Magnos and Theophilos, but in addition contains much personal experience of the author's; the theoretical foundation of his uroscopy is Galenic. Urine is a filtrate from the blood, derived from the inferior vena cava, from its composition therefore deductions may be drawn concerning the changes of the blood as a whole in disease. The changes which the urine undergoes through the affections of individual organs may be explained by sympathy. Joannes, like Theophilos, distinguishes numerous colours of the urine, observes the sediment, the *enæorema*,¹ the scum, and draws his conclusions on the lines of humoral pathology from his often very subtle observations. The vessel to contain the urine should be made of glass and divided into eleven divisions. The deposit takes up the four lowest of these, the *enæorema* the sixth, seventh and eighth, the scum the tenth and eleventh; the fifth and ninth constitute the intermediate spaces between the deposit and *enæorema*, and between the latter and the scum.

The most important work of Joannes Actuarius, the *μέθοδος θεραπευτική*, was written by him primarily for the use of his erstwhile fellow-student Apocauchos, on the occasion of the latter journeying as envoy to the hyperborean Scythians (Russians).

Joannes makes use in the psychiatric portions of his work of the doctrine of localisation of Poseidonios, explains the occurrence of tetanus by a determination of humours to the spinal cord, was familiar with the colic of lead-poisoning, and is the first person to describe the whip-worm (*tricocephalus dispar*). His teaching on the pulse was moulded upon that of Galen, but was far more lucid. He believed that venesection could cure morbid conditions of the humours as well as plethora, and he let blood for different affections at particular spots, e.g., for headache in the upper arm, in chest affections at the bend of the elbow, etc. He usually preferred derivative venesection to revulsive; in pleuritis the operation was performed upon the affected side.

The chief principles of Joannes Actuarius' psycho-physics were the following: the divine in man, the soul, is simple and endowed with manifold forces unembodied and amorphous. The organ of soul is the *pneuma*. The *πνεῦμα φυσικόν* is formed in the liver from nutriment and is the cause of sexual power; the *pneuma* that attains the heart through the inferior vena cava is there converted into the vital spirit *πνεῦμα ζωτικόν*, and is distributed by means

¹ *Enæorema*, that which is suspended, i.e. the floating cloud (of mucus) in the urine.

of the arteries through the entire body. The greatest transformation occurs in the brain, where the soul-spirit, the πνεῦμα ψυχικόν, takes its origin. Just as in plants the sap undergoes changes in all parts, so does the pneuma undergo transformations in every portion of the body and its different functions are conditioned by the varying structure of the organs, as light takes the colour of the particular glass it shines through. Mental activities are distinguished by him as perception (αἴσθησις), imagination (φαντασία), judgment (μέρος δοξαστικόν), understanding (διάνοια), reason (νοῦς). Reason is assigned the highest place and is least bound up with the pneuma, the power of imagination is subordinated to the other mental faculties.

THE TRANSLATION OF GREEK MEDICINE TO THE EAST THROUGH THE AGENCY OF SYRIA

SYRIA, with its heterogeneous, impressionable population, strongly adaptive because lacking a civilisation of its own, had, under the rule of the Seleucidæ, become acutely and intensely Hellenised, being reckoned in Roman times amongst the most highly civilised provinces. The rich towns possessed flourishing educational establishments, particularly Antioch and Berytos—from which sprang men who acquired fame in every branch of knowledge. Hellenic influences spread beyond the ever-changing Syrian borders and at times blended to a remarkable degree with the Semitic genius, as was instanced in the peculiar civilisation of Palmyra or of the Mesopotamian town Harran.

The Church, which had been firmly established in Syria from the end of the second century, furthered the expansion of Greek culture towards the East through its missionary activity in the foundation of schools in Mesopotamia—the most important were in Nisibis and Edessa—in which due attention was paid, not only to theology, but also to the study of profane subjects (grammar, rhetoric, poetry, dialectics, arithmetic, geometry, music, astronomy, medicine, etc.), partly for the purposes of exegesis, partly for the practical education of representatives of different callings, particularly of medicine. A fact of the most far-reaching importance was that, stimulated by the translation of the Bible and of the Fathers, there arose in the Christian educational institutions a prolific and many-sided activity in translation, which, from the fifth century onwards, placed at the disposal of the indigenous population an ever increasing number of theological, philosophical (*e.g.* works of Aristotle revised from the neo-Platonic standpoint), mathematical, scientific and medical Greek works in the Syrian tongue. The heterodox sects of the Jacobites (schools of Kinnerdin and Rasain) and Nestorians (Edessa) distinguished themselves pre-eminently by their zeal and mutual emulation in teaching and translating. The most eminent translator, who came into closest touch with medicine, was Sergios of Rasain (presbyter and physician in the first half

of the sixth century), who rendered works of Hippocrates and Galen into the Syrian vernacular.

Religious fanaticism drove the Nestorian scholars from their chief seat Edessa, temporarily in 432, finally in 489, and forced them to seek refuge beyond the confines of the Byzantine Empire in Persia, where, under the protection of the tolerant Sassanidæ, they were able to pursue their vocations as teachers and investigators. To their fruitful labours the old school of Nisibis owed its revival, and it was not long before other institutions arose, of which the academy of Jondisabur was the most noted. The teaching at these included natural philosophy as well as theology, and translations of Greek works into Syrian and Persian were undertaken.

Greek civilisation had made its influence felt in Persia even at the time of the Parthian dominion, but it was notably the Sassanidæ (ca. 224 A.D.) who, in spite of their rigid nationalism, encouraged the introduction of Greek art and culture. Greek physicians probably also came to the country, but it was not until the end of the fifth century that an exclusively medical training establishment appears to have been founded by the Nestorians in Jondisabur in connection with their church school.

Under the reign of the wise Chosroes Anosharvan (532-579), who devoted particular attention to the promotion of medical and philosophical study, the medical school of Jondisabur flourished exceedingly and became later, and for centuries remained, the most important of the academies of the East, constituting the point of intersection of the medical systems of Greece and India. The connection of the institution with a hospital proved of great advantage for the practical instruction of students.

When the Persians became subject to the rule of Islam, the Nestorians remained nevertheless in possession of the school of Jondisabur. The rapid development of Arabic medicine, which owed so much to this particular school, is proof of the restless activity that must have prevailed there.

ARABIC MEDICINE

“Gottes ist der Orient !
Gottes ist der Occident !
Nord- und südliches Gelände
Ruht in Frieden seiner Hände.”

THE extinction of the spirit of emulation and the dearth of fresh impulses had reduced medicine in Byzantium to a condition of stagnation; from the eighth century onwards, despite occasional flickerings, it possessed only a semblance of animation. Fortunately the fate of mediæval medicine was not dependent upon Byzantium alone. An admirable illustration of the doctrine of conservation of energy is afforded by the fact that, with the decline of intellectual energy at home, a contemporaneous development of Greek medicine took place abroad, which, if at times misguided, was yet full of vitality, whilst the medical art of the newly arisen world of Islam reached a height unsurpassed during the Middle Ages.

The development of medicine in Arabic countries was closely bound up with the power of the Califate, with its rapidly grown and luxuriant civilisation, and was founded upon a revivification of the fundamentals of Greek culture by the ferment-like action of the genius of the East, whose nations under the triumphal banner of the Prophet had been roused to a life of strenuous activity. Tilled by the ploughshares of Arabian energy the freshly turned ground of the earlier civilisations, Syrian, Mesopotamian and Persian, Egyptian and Indian, brought forth an abundant crop, springing for the most part from the lavishly scattered seed of Greek thought, but not entirely lacking in acquired peculiarities due to the specific influence of the soil.

A new edifice arose, blending Greek elements with oriental, in the shape of Arabic medicine, the rapid rise of which is only comprehensible in the light of the previous achievements of the ancient civilisations of Egypt, Syria, Mesopotamia and Persia. Neither foundations nor superstructure were exclusively or even pre-eminently the work of the Arab pure and simple. It is true that the rich and many-sided medical literature constitutes, both in language and intellectual tendency, a homogeneous

whole, but in its creation a part was played, not only by the Arabs, but by the different nations composing the Islamic world-dominion which in its prime extended from the Himalayas to the Pyrenees, from the Black Sea to the Gulf of Aden.

Arabia itself, which gave its name to a civilisation of common Semitic, Aryan and Hamitic origin, remained without influence upon the scientific art of healing; the centres of "Arabic" medicine were to be found in lands with a mixed population.

Nevertheless civilised medicine was by no means a complete novelty to the conquering Arabs, for they had previously learnt to recognise its superiority in their own country, even in pre-Islamic times, through the Jewish and Christian physicians who lived amongst them and practised along with the indigenous healers, representatives of native superstitions and empirical traditions. Many traces point to the fact that, here and there, even in remote times, connecting links were forged with Syrian, Persian or Indian medicine.

The highly esteemed Christian physician el Harits ben Kalada, a contemporary of Mohammed, from el Taif near Mecca, studied at the academy of Jondisabur and travelled in India in order to extend his knowledge. It may be noted that he influenced the Prophet in his hygienic and medical views, which he was the better qualified to do since he himself laid down rules of health, inculcating moderation and cleanliness suited to the Arab methods of life.

Hygienic and medical matters play as important a part in Mohammedan and religious writings as in those of older religions. The hygiene contained in the Koran, although of less wide range than that of the Old Testament, is nevertheless no negligible quantity. It contained precepts upon cleanliness, food (forbidding the use of pork and wine), sexual life, etc.; but little, on the other hand, which serves to throw light upon the medical conceptions of the age. In this connection an interesting complement is furnished by the sayings traditionally ascribed to the Prophet and later known as "medicine of the Prophet": in addition to native popular tradition, foreign influence is already visible, having made itself felt through the agency of Jewish and Christian physicians. The Prophet, who himself undertook the treatment of minor ailments, and especially enjoined upon believers the care of their health, advised the use in certain diseases of drugs or rational remedies (*e.g.* cold affusions and scarification for chronic headache and fever), admitted under certain circumstances methods of superstition, where they were not too obviously in contradiction to monotheism, and in urgent cases permitted the patient to deviate from strict observance of ritual. The actual cauterisation is the last resource in disease and as a hæmostatic; the treatment of fractures by reposition and bandaging is briefly mentioned; bites of snakes or rabid dogs were treated by incision of the wound, sucking and cupping. The outbreak of a contagious epidemic was the signal for caution, but leaving the country was forbidden.

Whilst the brave and gifted, but as yet unsophisticated Arabs, aflame with religious exaltation, were by invasion making themselves masters of all the richest civilised countries, refinement and culture possessed little interest for them; in their barbaric pride they esteemed the learning, the arts and crafts and the industries of the conquered only as services which might with advantage be rendered to the dominant martial race. Apart from their fervid and emotional poetry, the only outlet for their intellectual activity was in writing upon purely religious topics, to which was added by degrees the study of Arabic grammar in order to assist in the establishment of the sacred text and for the sake of converts, to

whom the Koran could only be communicated in the original, not in a translation, a circumstance leading to the promotion of Arabic to the position of a literary language.

Fostered by the antagonism of religion and language the apathy of the Arabs towards foreign culture was maintained during the first century of the Hejira and even beyond it, the more so since the best talents were fully engaged, partly upon campaigns, partly by internal dissensions. Although the Ommiade Califs transferred their residence to Damascus, the chief seat of Græco-Syrian culture, replaced the earlier simplicity of their habits and customs by a more refined mode of life following the example of the Byzantines, and offered hospitality to foreign artists, savants and physicians, who were held in no little esteem, yet any considerable promotion of non-Mohammedan knowledge was as yet incompatible with a nationalism founded upon religious inspiration. The care of science and the arts was mostly relegated to unbelievers. Only where practical interests were at stake, or where the allurements of mysticism made themselves felt—in alchemy and medicine—were there noticeable, even at this epoch, traces of a desire for knowledge or even of a more serious attempt to acquire it, wherein the erudition of Alexandria served as the chief source of inspiration. The Ommiade prince Khaled ben Jezid is chiefly known for his services to alchemy, whilst Theodokos and Abd el Malik ben Abhar Alkinani deserved credit for assistance rendered to Greek medicine. A Jewish physician, Masarjawaih of Basra (ca. 683), translated into Arabic the Pandects of the Presbyter Ahron which already existed in the Syrian tongue. As early as the year 707 the Calif el Welid, who did much to further knowledge and art, founded the first hospital and appointed physicians thereto. Although even in the time of the Ommiades, Basra and Kufa, where Moslems, Christians and Jews met on common ground, had become centres of scientific education, the real rise of Arabic civilisation came to pass only upon the accession to power of the Abbasides (750). Its development, as rapid as it was many-sided, under the Califs of this house had, at its commencement at least, relation to the fact that the Arabs as a nation had yielded their predominance in the state to a mixed race of gradual origin, the Persians in particular, through their Arabianised descendants, attaining an influential position.

The transition to liberal cosmopolitan tendencies with their sequence of higher forms of economic and intellectual life soon found expression in the transference of the capital to Bagdad which, built upon Mesopotamian soil, embodied the traditions of the ancient oriental world-empire and, as the point of intersection of all the great trade-routes of the Near East, was

the natural mart for international traffic. With the glamour of the court upon it, emulating Byzantine æsthetics whilst outvying Persia in luxury, magnetically attracting to itself the population and treasures of two hemispheres, Bagdad grew to be the greatest and most splendid of all cities. Here sprang into being those mighty impulses whereby the treasures of nature were disclosed and turned to account, new tasks set to industry, and interchange of goods facilitated by the improvement and multiplication of means of communication.

The seat of a world-controlling power, the centre of industry and commerce, the scene of boundless luxury and reckless indulgence, Bagdad became also an academy of learning, and in the domain of intellect no less than in that of material culture the exclusive and potent motive underlying the astonishingly fruitful labour whereby foreign civilisation was assimilated was to be found in the determination and ambition of the Califs.

At the end of the eighth and the commencement of the ninth centuries, at a time when the Califate was at the height of its power and Moslem prosperity assured by a flourishing agriculture, great industrial activity and extended commerce, there began that remarkable intellectual movement which exercised so great an influence upon the history of the world, and which, within a short space of time, introduced among the Arabs an astounding amount both of occidental and oriental culture. That which had its inception in Syria and Mesopotamia through the introduction of Hellenic knowledge, and which was matured in Persia under the Sassanides, achieved, under the Moslems, an undreamt-of consummation, since they advanced, from a wholesale adoption of foreign civilisation, through the stage of complete assimilation to that of original performance.

Following the example earlier set by the Assyrians and Persians the Arabs based their scientific knowledge upon a voluminous translated literature.

Although isolated writings had previously been rendered into the language of the Koran, systematic translation on a large scale, embracing by degrees every branch of knowledge, was not undertaken until the Abbasides, friends of progress, mainly inspired by their court physicians, supported the undertaking with ample means, and interested themselves in obtaining the costly original manuscripts, at times only to be acquired through diplomacy, instituting special commissions of scholars for the carrying out of the work. The example thus set by the rulers naturally soon awoke an inclination amongst the great similarly to play the part of Mæcenas. In this respect the memory of the Abbasides al-Mansur (754-775) and

Harun-al-Rashid (786–802) finds a lasting place in history, as does that of the distinguished family of Barmecides. The most splendid memorial was, however, established for himself as patron of art and science by the Calif al-Mamun (813–833), who brought together the largest collection of writings and founded a special institution for translating, placing it under the direction of distinguished scholars. Under the favour of this ruler's successors—particularly of the Califs al-Mutassem, al-Mutawakkil and al-Mutadhid—translation was continued until, from the commencement of the tenth century onwards, it made way for commentaries and a less restricted use of accumulated knowledge.

Persian and Indian literature was taken into account as well as Greek, the latter, however, forming the bulk, being at first translated from the Assyrian, later, directly from the original. As regards their contents, at first, in keeping with their practical ends, medical, mathematical, astronomical and geographical works were dealt with, in process of time also those upon philosophy and science.

Amongst the prominent names in the long list of translators, of whom Arabic sources give some hundreds, are, in relation to medical and scientific writings, Jahia ben Masawaih ("Mesue" or "Messua"), Hunain ben Ishak ("Johannitius"), his nephew Hubaish ben el Hasan, the Sabian Thabit ben Kurra of Harran and Kosta ben Luka. All the most important medical authors were rendered into Arabic, particularly Hippocrates, Dioscurides, Archigenes, Ruphos, Galen, Oreibasios, Philagrios, Alexander of Tralles and Paulos of Aegina. These Arabic translations are even to-day of the greatest value, partly for exegetical reasons, partly because they fill many of the gaps in ancient literature.¹

The first Abbasides, particularly al-Mamun, acquired numbers of holographs by purchase or solicited valuable manuscripts from the Byzantine court; it is related of Harun-al-Rashid that he captured numbers in Greek towns; of al-Mamun that he made the surrender of such literary treasures a condition of peace. Early translations were made of the elements of Euclid, of the *Almagest* of Ptolemy and Aristotle's physics.

The translators were for the most part Syrians, Persians, Greeks and Jews, most of whom practised medicine exclusively or in part, and it was this art more than any other which roused the enthusiasm of the Califs.

That the Arabs in their zeal for translation should have neglected the poetical and historical works of antiquity is simply explained by the fact that poetry and historiography had with them been independently developed. Religion on the one hand and a strong national feeling on the other deprived them of all receptivity for even the loftiest emanations of the genius of antiquity and made them incapable of understanding Greek art and Greek poetry.

¹ Thus the Arabs possessed far more of Galen's anatomical works than have come down to us; the great gaps in the original of the books 9–15 have only been filled by means of the Arabic translations.

This industry in translation, fostered with unexampled devotion, following well defined lines and systematically carried out, placed at the disposal of the Arabs as early as the ninth century an astoundingly complete and ever-growing sum of knowledge, and whereas learning was everywhere else at a standstill or decaying, ancient culture underwent in Irak a brilliant renaissance. Aristotelian and Platonic writings were read in Bagdad with youthful curiosity of mind; based upon Euclid and Ptolemy the study of mathematics and astronomy was pursued; Hippocrates and Galen were the teachers at the bed-side.

It would nevertheless be a misconception to suppose that in this early period of their intellectual advancement the Arabs were content with slavish imitation or surrendered themselves to blind adherence and uncritical reverence of foreign masters without even an effort to strike out an independent line. Although the intellectual world to them newly discovered dazzled the Arabs with a splendour to which none could be blind, yet it was precisely the contact with this inheritance of Greek thought which awakened the native intelligence, whilst critical faculties were sharpened by the extraordinarily diverse, if often contradictory civilising influences which accrued from West and East.

The genius of this nation, thirsting for conquest, haughty and apt for assimilation, was soon directed towards converting foreign acquisitions by elaboration and purposeful adaptation and development into national possessions. Independent achievements, indeed, could at first only be wrought in isolated cases and in restricted spheres, but as early as the second and third centuries of the Hejira there were not wholly wanting men in the world of Islam who by their industry proclaimed the fact that Bagdad had, not without justification, assumed the fallen mantle of Alexandria.

The transition from mere translation to paraphrastic popular rendering was a rapid one, even textual exposition awakening a more independent line of thought in keeping with the conditions of the time and the national spirit.

The golden age of the Abbasides was not only characterised by universality of knowledge, derived with fanatical enthusiasm from varied sources, but even leanings towards polite learning made themselves felt and, in the attempts to reconcile science and belief, philosophical speculation had, temporarily at least, to be on a higher plane, not hesitating at very daring conclusions. After the death of el-Mamun there was indeed an orthodox reaction which, beginning quietly, had, by the end of the ninth century, assumed considerable proportions and was only too successful in curbing freedom of thought.

A fact of greatest significance, however, was that in learned circles of Bagdad not only were theology and philosophy, philology and literature studied, but a deep and lasting enthusiasm was aroused for the different branches of mathematics and natural science and, in these subjects in particular, despite the fact that inspiration was constantly sought from the achievements of the ancients, new ideas, fresh observations and wider experience were added to the sum of inherited knowledge. The great Geber had, as early as the eighth century, indicated the path along which the Arab genius was to attain its greatest triumphs, but only in Bagdad, where eminent masters united in common labours, where the means of scientific investigation were readily accessible (*e.g.*, by the foundation of observatories), could research, dealing with figures, weights and measures, progressing step by step from the known to the unknown, find an adequate number of disciples.

Dissemination of knowledge was ensured by schools and well stored public libraries; the busy traffic¹ which led would-be learners to the metropolis facilitated acquaintance with new writings and intellectual achievements.

Bagdad maintained for centuries its fame as a focus of intellectual life, although education and culture emanated from it as in a broad stream, running in many channels and extending into the provinces to the farthest East (Samarkand); even neighbourhoods, sunk to-day in profoundest barbarism, remained educational centres, temporarily at least modelled upon those of the capital.

Although Arabic culture had to thank the patronage of the Abbasides for its inception, it was fortunately not wholly dependent upon the power of the Bagdad Califs for its continuance and development. Whilst the Califs were, by defections of ambitious governors, confined to an ever narrowing domain, and eventually, the real power passing into the hands of leaders of mercenaries, became merely figure-heads surrounded by a spiritual halo, the intellectual life continued in full vigour for centuries.

¹ Good roads, bridges, caravans, inns, rivers, etc., facilitated intercourse throughout the country; the abolition of inland taxes guaranteed emigration and settlement; harbours were provided for the benefit of shipping.

The tendency towards travel, stimulated by the great extension of the Arabic dominion, was very widespread; it arose not only from religious impulses (pilgrimages) or commercial interests, but also from pure thirst for knowledge. A saying attributed to Mohammed runs: "Whoso leaveth his house to seek wisdom pursueth the path of God until his return." The assurance of finding, throughout the extensive dominions, knowledge of the Arabic language, fellow-feeling and a hospitable reception, made no distance too long where fresh knowledge was to be acquired or where famous teachers were to be heard. "Wanderer in every clime" was an honourable title. This impulse towards travel in search of knowledge was particularly favourable to geography, a subject to which the Arabs made many contributions.

The division of the realm into numerous independent principalities even had a beneficial effect, since many of the new dynasties, entering distantly into competition with the Abbasides and with one another, encouraged technical and scientific endeavour, attracted scholars and founded educational establishments and libraries ; such independent powers were the Sassanides in Bokhara, the Ghasniwides in Ghasni, the Buwides in Persia, the Hamadanides in Aleppo and Mozul, the Aglabides in Kairwan, the Edrisides in Maghrib.

The level reached in Bagdad is comparable only with that attained in Andalusia in heterogeneous Spain, where the Arabs had been firmly established since 711 ; a century behind that of the East, the development of Arabic civilisation on the banks of the Guadalquivir ran a course parallel with that upon the Euphrates and Tigris, finally to surpass in many respects the achievements of the motherland.

The nucleus of such a development owes its origin to the contemporary of al-Mansur, the Ommiade Abdurrahman, who, escaping alone from a massacre instituted by the Abbasides, had set up the banner of independence in Cordova. Uniting wisdom and leniency with bravery in war, this prince adorned his capital with magnificent buildings and strove to invest his kingdom with the glamour of Abbaside civilisation. Following ancestral example, the firm-handed rulers of the Spanish Ommiade dynasty (755-1036) fostered, with highly creditable zeal and far-reaching results, not only the material well-being of the country, but also its intellectual aspirations and its arts and crafts. The reigns of Abdurrahman III. (961-976) and Hakem II. (961-976) coincided with a veritable golden age wherein Cordova, the town of the Califs, became the Bagdad of the West, the home of the highest culture and the most refined art, the repository of a rich store of books, a centre for scientific endeavour, a school for thousands of eager learners. In other large towns, too, from the tenth century onwards, a vigorous civilisation sprang up, emanating from Arabs, Berbers, Jews and Mozarabes, which through its own vitality survived upheavals, loss of power and even the dismemberment of the kingdom, and up to the thirteenth century could always command princely support.

The Arabic civilisation in Spain is also known as the Moorish because the greater number of its representatives was derived from Barbary. The fact must, however, be emphasised that it was the Arabs proper who exercised the greatest intellectual influence. Cordova and Bagdad remained united in spirit although civilisation in Andalusia underwent an occidental modification, partly through conditions of country or race, but more from relationship with the Christian Spaniards.

Under the sceptre of the almost without exception admirable rulers of the house of Ommeyah

Spain attained a degree of prosperity never again reached, by means of improvements in agriculture, stock-raising, mining, irrigation, etc., and through promotion of trade and industries. Maintaining an active industrial and intellectual connection with the highly developed civilisation of the East, Moorish Spain enjoyed all its advantages without suffering from its despotic oppression—a happy state somewhat analogous to that of Greece in the Old World.

Even after the fall of the Ommiades the arts and sciences flourished, finding protection at the courts of the various rulers. In the twelfth century Spain is supposed to have possessed seventy public libraries and seventeen higher educational establishments, many writers emanating, not only from Cordova, but also from Almeria, Murcia, Malaga, Granada and Valencia.

A most important rôle in the intellectual life of the day was played by the Spanish Jews who, till the Moorish conquest, had languished under the oppression of the Visigoths and had later much increased in number by immigration. Under Arabic rule they enjoyed true toleration and were free to develop their faculties; many even attained to high dignities. On account of their linguistic knowledge they were apt in translation, and thanks to their ancient culture, distinguished themselves as pioneers in various branches of science, as physicians, philosophers and poets.

In sharp contrast with the considerable influence wielded in the East by the Nestorians and Syrians the part played by the Spanish Christians was only a small one, since the position of the cleric was lower than in the East.

In Egypt, the youngest Califate, learning found less support. It is noteworthy, however, that in the year 1005 the Fatimide Hakim Biamrillah built the so-called "House of Wisdom," *i.e.*, a kind of academy and university, in connection with a library filling eighteen halls. Here dissertations were given for students of every branch of knowledge by highly paid scholars—theologians, lawyers, philosophers, philologists, mathematicians, astronomers and physicians.

Arabic civilisation in its prime, which surpassed that of ancient Rome in animation and variety, and all its predecessors in comprehensiveness, lasted until the commencement of the eleventh century. After this date unfavourable political conditions and industrial decay had a disintegrating effect which was heightened by religious dissensions, and particularly by the final triumph of orthodoxy. The decline came in the thirteenth century; in the West the fall of Cordova (1236) set the seal to its fate; in the East the Mongol invasion terminated the rule of the Abbasides in Bagdad (1258) and reduced the edifice of civilisation to a ruin past rebuilding. Nevertheless for centuries after this golden age the achievements of Moorish Spain were by no means inconsiderable, much being accomplished also in Egypt, of which country the Mongols stopped short, whilst even under the rule of the Seljuks and Mamelukes intellectual aspirations were by no means wholly quenched, and even in the present day may be traced the impress which the Arabic epoch left upon the evolution of mankind.

The sum total of achievement in this era is enormous ; no branch of knowledge was unrepresented in it. Following upon a surprisingly short introductory phase in which the knowledge derived from the world of nature and of the intellect was assimilated and turned to good account, the arts and sciences, crafts and industries attained a development the range and extent of which we can hardly picture without the aid of the imagination. After a long interval there was once again progress along several lines, an active industrial, artistic and scientific life, and, in spite of the strong attachment to the great prototypes of an alien past, Arabic creations bear witness to the peculiarities of place and time and to the thoughts and emotions of the national mind.

The maintenance of old and the foundation of many new towns offered a suitable field for the arts of peace ; the wonderful advance of civilisation was favoured in a high degree by the disappearance of the aristocratic military caste ; the absence of any proper clergy prevented culture becoming the prerogative of one class alone and, amid the quickening intercourse of nations, with the emulation amongst the numerous centres of light and learning, conventionality was never able to acquire so strong a hold as to destroy individuality. A voluminous literature, embracing every subject, a comparatively highly developed system of education, ensured the continuity of research, the dissemination of knowledge ; a conjunction of advantageous extraneous circumstances favoured the pursuit of science, made possible the execution of boldly conceived projects, and improvements in methods.

The most flourishing branches of science—apart from theology, jurisprudence, philology and history—were the mathematical and empirical, and it was mainly upon these that the industry of translators and later of original investigators was concentrated. It was not thirst for knowledge alone which lay at the root of this bias, but also the principle of utilitarianism, just as, in the character of the sons of the desert, the love of conquest was balanced by keen commercial instinct.

The success of the Arabs was greatest in mathematics, astronomy and geography, in mechanics and optics, in chemistry, botany and mineralogy wherein, by means of new and important discoveries, they surpassed their predecessors, following, not slavishly, but independently, in the footsteps of the Alexandrians. Repeated observation and experiment led to great additions to the sum of inherited knowledge ; keen analysis and accurate classification enhanced the value of the mass of facts collected with such astonishing assiduity, and the high degree of technical development attained is evidence of the beneficial influence of theory upon practice.

The Arabs introduced the Indian numerical system into mathematics, improved the fundamental arithmetical operations and added to the knowledge of algebra and trigonometry. Their services to astronomy are well known, scientific terminology is reminiscent of them even to-day. The Arabic geographers introduced greater exactness into their science by bringing

it into touch with mathematics and astronomy. The mechanics of solid and fluid bodies received great attention: Arabic investigators employed extremely sensitive balances, made use of the pendulum for measuring time and evolved new methods for determining specific gravity. In optics they added to the knowledge of the laws of reflection and refraction of light and applied them to the elucidation of astronomical problems. Chemistry, in particular, made important strides—although indeed from an alchemistic point of view—partly through the improvement of, and addition to, methods of research, partly through the preparation of new substances.

Recent investigations have established the fact that the Arabs derived from the East (from the Chinese) the use of the compass and the manufacture of paper, possibly also the use of mixtures resembling gunpowder.

It is an open question to what heights such a civilisation would finally have attained if its development had not encountered an untimely check through political decay and orthodoxy. The actual achievements, although their mediæval origin has in many cases passed into oblivion, leaves the general impression that, in spite of the considerable accumulation of experience, there resulted from this immense industry no epoch-making discoveries in general knowledge, that the Arabs, caught in the bondage of late Hellenic methods of inquiry, never appreciably rose above the intellectual level of their predecessors. It was in no sense a renaissance of the genuine free Greek spirit, rather a sympathetic perpetuation of Alexandrianism, enfeebled by neo-Platonism.

Islam in its prime shares with Alexandria many merits and demerits, the latter accentuated by subservience to authority and by the trend of the oriental mind. Hence there was on the one hand astonishing industry in compilation and fruitful study of philology, mathematics and individual branches of the exact or descriptive sciences, on the other predilection for encyclopædic polygraphy, prepossession by *a priori* or superstitious prejudices, and that fatal fetish-worship of the abstract idea which, with a pedantry born of linguistic study, frequently allowed sequences in logic to take the place of those in fact, and which gave preference to the manner of presentation of formal thought over the thought itself.

Greek knowledge was, like the Koran, looked upon as something permanent, of unalterable value, demanding elucidation and amplification, but not fundamental critical inquiry, and thus the chief function of investigation was to convert hereditary and acquired experience into inferred knowledge, to formulate traditional habits of thought as axioms, to support inherited systems by unassailable proof. Whilst giving due credit to those individuals who maintained their independence, and admitting that, within narrow limits, results of considerable importance were actually obtained, it remains nevertheless true that in the thralldom of logical technicalities much intellectual energy went to waste and many

a hopeful inauguration of a new view of cosmic theories remained undeveloped because keen-witted plausibility and daring assumptions constantly obscured the contrast between scientific tradition and open-minded inquiry. Thus, for instance, in spite of chemical progress, the theory of the four elements held its own.

Courage was required to admit the antagonism between theory and practice, and uncompromising rationalism found the greater scope since that constructive imagination was lacking which, disregarding tradition, leads to truly great results in natural philosophy. Just as Arabic poetry produced no drama, as the Arabs clung to the decorative in art, so in Arabic science, in spite of the foundations laid by patient labour, no revolution in knowledge was effected ; it represents a process of intellectual digestion, not one of generation.

The best proof of the fact that reliance upon authority acted as an inhibitory influence upon free development, and that a disparity existed between ingenuity and profoundness, to the disadvantage of the latter, is afforded by Arabic philosophy, which, indeed, had centuries earlier dealt with the same problems that later occupied the West, but which never attained a position of independence. Even the leaders in the world of abstract thought—Avicenna in the East, Averroes in the West—were travellers in a previously explored land.

In the development of science as a whole the chief task of the Arabs appears to have been the elaboration and detailed development of ancient doctrinal systems by pursuing them to their logical issues, by the addition of a wide and ostensibly conclusive experience, whilst making the most of their applicability to the conditions of the time. The inadequacy of fundamental principles, the incompatibility between theory and practice were bound gradually to result in an unbiassed outlook free from the trammels of authority. Such a purview was, however, out of reach of the Moslem age, the energies of which were too much engaged in evolving postulates, colourable plausibilities and conciliatory attempts at compromise. It was reserved for far later epochs, to which the Arabic with its instructive errors and empirical knowledge was a stepping-stone, to break through the bonds which fettered thought and to establish a new conception of nature.

The medical art of the Arabs embodies a paradigm of the ancient doctrine of Galenism, logically and consistently carried out both in theory and in practice.

This impression would probably not be weakened even if sufficient material came to hand for a real history of Arabic medicine, which could not at present be written, since the litera-

ture has so far been quite inadequately investigated. An enormous number of medical manuscripts remains unused in the libraries ; in Arabic characters there exist only eighteen works ; very little has been translated into modern languages—what there is deals mostly with anatomy, pharmacology and ophthalmology. The verdict upon the poor character of the mediæval Latin translations is unanimous, taken alone they furnish no adequate picture of Arabic medicine, although the fact should not be lost sight of that it was through these “Perversiones,” as they have been contemptuously called, that the medical art of the Arabs influenced that of the West.

Medicine amongst the Arabs occupied a most important position, in accordance with which its historical course shows a clearly defined dependence upon all those factors which determined the trend of Arabic civilisation in general.

An extraordinarily rich and many-sided literature has come down to us, the best part of which dates from the period between the tenth and thirteenth centuries.

The high esteem in which medicine was held by the Arabs is reflected in the literature, amongst other ways in the fact that medical questions are discussed, not only in technical writings, but also in treatises upon other branches of knowledge, *e.g.*, in those upon philosophy, natural science and particularly upon travel. Even poets dealt upon occasion with medical subjects. Thus one of the most famous, Motanebbi, described in a didactic poem a fever from which he had suffered, presumably from lack of sufficient exercise.

Apart from early Syrian and Alexandrian influences which paved the way for Arabic medicine (cf. p. 348) the actual cradle of the latter may be looked for in the Nestorian school of Jondisabur (cf. p. 345). From it came those physicians who brought their art into the highest repute at the court of the Abbasides and who gave so great an impetus to translation (cf. p. 350), contributing more than any others to the establishment of scientific research and instruction in the art of medicine in Bagdad. This origin stands in intimate relation with the fact which may be here pointed out, that the Persian Arabs took once for all a leading place in Arabic medicine.

The great importance of the school of Jondisabur, which, during the first centuries of Islam, spread enlightenment throughout the entire East, lies, not only in the fact that it constituted a meeting-place for Græco-Syrian and Indian medicine and the centre of activity in Syrio-Persian translation, but also in the circumstance that it provided for the practical instruction of students in a hospital provided with a well-equipped dispensary.

Thanks to the instigation of Nestorian court physicians (of the Bakhtishua family, of Messua) and particularly in consequence of the astounding industry of the tireless Hunain, around whom a crowd of assiduous translators collected, the Arabs were, before the close of the ninth century, made familiar with Greek (and to a certain extent with Indian) medicine, and that in a manner which rendered possible an

exceptionally early transition to a paraphrastic and increasingly independent treatment of the subject-matter. In this connection, indeed, it should be borne in mind that these first-fruits of Arabic literature owe their origin mainly to the Christian translators and least of all to the native Arabs.

Of the fairly comprehensive literature of this early epoch a few writings have survived in mediæval Latin translations, a proof of their lasting influence. These are the "Aphorisms" of Messua (the elder),¹ an introductory commentary of Hunain or Johannitius to Galen's "*Ars Parva*"—"Isagoge," the treatise of al-Kindi or Alkindus, "*De medicinarum compositarum gradibus*" and a compilation upon special pathology and therapeutics, translated from the Syrian, the "Aggregator" of the elder Serapion.

Scanty though the material is it yet affords, in conjunction with quotations from later authors, an adequate insight into the nature, aims and achievements of the dawn of Arabic medicine. Persians and Syrians as well as Arabs, the former heirs to ancient traditions and methods of investigation, the latter apt pupils, looked upon the medical masterpieces of the Greeks, and particularly of Galen, as infallible oracles and directed their zealous endeavour, on the one hand only towards embellishing by means of practical experience (especially therapeutics) an edifice of learning apparently perfect both in foundations and superstructure, and on the other towards affording it support by logical methods and mathematical and scientific additions.

In the philosophic atmosphere of the Abbaside court it was considered indispensable that every branch of knowledge, including medicine, should be grounded upon a rationalistic basis and should be treated from the point of view of Aristotelian logic. As upon the doctrinal principles concerning faith and duty, so in medicine, erudite discussions were held as to whether its foundation rested upon tradition, reason, or knowledge founded upon reason; whether its principles could logically be deduced from those of mathematics and natural science. The physician was supposed to know the "natures" of articles of food and medicaments, the composition of the body and the movements of the stars; he was expected to learn from the alchemists and practise his art in accordance with logical, mathematical and scientific principles.

Hence it was that, in addition to actual empirical progress—in the branches of *materia medica* and dietetics—there was noticeable from the first a method of treatment of the subject-matter distinguished by dialectical sophistry on Aristotelian lines, by a passion for distinctions and classifications, but in addition by more or less striving after exactness which, however, found no better outlet than in the subtleties of pulse

¹ Here, as later, the authors' names and titles of books are mainly those in use in the mediæval West and, almost exclusively, the medical writers mentioned are those whose influence has extended beyond the confines of Arabic civilisation.

and urinary diagnosis, in precise directions concerning phlebotomy,¹ in numerical jugglery and astrological portents.

The "Isagoge" of Hunain (Johannitius), which throughout the whole of the Middle Ages served as an initiatory text-book of medicine, furnishes a concise review of the Galenic system, starting from the seven "res naturales," the six "res non naturales" and the three "res præter-naturales."

One of the fruits of the craze for distinctions was the extremely complicated doctrine of the organic forces, which is expounded in the "Isagoge" of Johannitius. The foundation of this doctrine was a keen-witted analysis of physiological functions, which also found application to pathology; thus atrophy and hypertrophy, as well as certain skin affections, were ascribed to functional disturbance of the nourishing forces.

A classical example of the premature application of mathematics to medical theory is furnished by the treatise of the "Arabic philosopher" al-Kindi, who applied the Galenic doctrine of qualities and degrees to complicated mixtures of drugs and by means of the law of geometrical progression thought to have established an exact method of prescribing.

The theorising proclivity, with its *a priori* conceptions, was a serious obstacle in the way of strictly open-minded, unbiassed study. The diligence of translators had indeed early clothed the knowledge and teachings of the Greek physicians in Arabic garb, but the spirit which animated all the greatest achievements of ancient medicine remained for the most part unrevealed. The art of exposition as practised by Alexandrians and Syrians was indeed favourable to development of erudition, but hardly of a full understanding of the inestimable value of independent evidence of the senses, and Galen, who with Aristotle was worshipped as a god, obscured the view of Hellenic medicine in its noblest form—Hippocratism. Few indeed succeeded in finding their way through the wilderness of controversies back to the Coan master, and none so readily as the physician with whom the maturity of Arabic medicine may be said to begin—Rhazes.

Rhazes was born about 850, and studied philology, mathematics, philosophy and music before, at the age of thirty, devoting himself to medicine. He acquired an excellent medical education at Bagdad, where he later became famous as director of the hospital, teacher and court physician. He journeyed far afield for purposes of study, was in touch with the most eminent investigators and was the author of over two hundred works dealing with philosophy, mathematics, astronomy, physics and chemistry as well as with medical subjects. He was highly esteemed for his learning and diagnostic and therapeutic skill, but an obscure and embittered old age followed upon a brilliant manhood. He died, blind and in poverty, in 923 or 932.

¹ The elder Serapion lays down subtle directions for the choice of spot in blood-letting. Following the Galenic vascular theories the Arabs evolved a doctrine of great importance in practice upon the choice of veins according to the seat of disease. For the most part the "revulsio a contrario" was preferred; i.e., the venesection was performed, not on the affected, but on the sound side. Whilst Hippocrates and Galen as a rule carried out venesection upon the affected side, the methodists made a law of the "revulsio a contrario" and both Archigenes and Aretaios performed it on the sound side.

Rhazes was a man of rare attainments, who linked the knowledge of his age to the achievements of the past, a tireless writer of immense productiveness and versatility, an inspired teacher—but his also was a more precious gift than erudition, the power to read in the book of nature itself, the clinical insight which ever sees something fresh at the bedside and assures to each case comprehension and treatment according to its individuality. Herein—not on account of his book-learning in which he was equalled or excelled by many of his successors, but as a clinician—he stands high above all Arabic, possibly above all mediæval physicians, although he never entirely succeeded in emerging from the shadow of Galenism.

In his theories of disease Rhazes was a Galenist; in practice, on the other hand, he was guided more by the principles of Hippocrates, aiming at an individualising therapeutic method based upon observation of the course of the disease, and laying stress upon hygienic and dietetic measures associated with simple drugs. “At the commencement of an illness,” he says, “choose measures whereby the strength may not be lessened.” “Where thou canst cure by diet, use no drugs, and where simple measures suffice, use no complex ones.”

It is also characteristic of Rhazes that he set greater value upon description of disease than upon theoretical speculation; his works contain numerous clinical histories which are proof of his admirable powers of observation. He expended great care upon diagnosis and prognosis; unlike most of his contemporaries, however, he did not overestimate the value of uroscopy, setting his face in particular against the degeneration of this method into quackery.¹ Rhazes was guided by independent experience, not only in his clinical descriptions, but also in therapeutics, wherein he experimented with chemical preparations.

His really gigantic *magnum opus*, “al-Hawi,” or “Continens” (Content of Medicine), affords the best insight into the scene of his scientific activity, and represents the fruit of a long life spent in untiring labour. It contains an astounding mass of extracts (mostly literal) from Græco-Arabic and Indian literature, from Hippocrates to Hunain, as well as numerous records from his own practice, covering the whole range of medicine. Unfortunately the author’s was not the last hand to touch the work, which was published only after his death, and the defective nature of the material, the unequal treatment of individual chapters, bespeak the fact that it is

¹ Deception by means of uroscopy had brought wealth and position to many. As an instance it may be mentioned that in the year 766 Abu Korcish Isa was created court physician to the Calif al Madi because he predicted by this means the birth of a son to the latter’s wife.

only an immense collection of excerpts and original notes which might have served as the groundwork for a methodically carried out encyclopædia of medicine.

The above-mentioned extrinsic deficiencies, but in particular the immense size of the "Hawi," which was bound to appal the reader, brought it about that a second work of Rhazes, the "Kitab al tib Almansuri," or "Liber medicinalis ad Almansorem," a compendious general review of medicine, dedicated to the governor of Chorasan, al-Mansur ibn Ishak, attained a greater reputation from a practical point of view. This work is distinguished by lucidity, and, although largely a compilation, by wealth of contents.

Rhazes has acquired lasting fame chiefly through his work upon small-pox and measles, "De variolis et morbillis" (earlier named "De pestilentia"), which on every hand and with justice is regarded as an ornament to the medical literature of the Arabs. It ranks high in importance in the history of epidemiology as the earliest monograph upon small-pox and shows us Rhazes as a conscientious practitioner, almost free from dogmatic prejudices, following in the footsteps of Hippocrates.

The earliest Arabic and western reports upon the existence of small-pox date from the sixth century. The first mention by medical authors is found in quotations by Rhazes from the Pandects of Ahron. Ahron described small-pox as a universal pestilence which arises from miasmatic influences and in particular attacks those who have long neglected venesection.

Rhazes quotes several Arabic precursors in his monograph and is of the opinion that small-pox was known to Galen. He does not clearly differentiate measles from small-pox, but describes the former as a clinically, but not nosologically distinct subvariety of the latter. He considers measles as, on the whole, more dangerous than variola, with exception of the blindness so often resulting from the latter. The word "Hasbah" no doubt connoted more than the present word "morbilli," and may well have included scarlet fever and other diseases. His theoretical conceptions are coloured by humoral pathology and culminate in the assumption that disease represents a necessary process of purification of the blood comparable with the fermentation of wine, contamination having occurred in fetal life by the menstrual fluid, unshed during pregnancy.

Rhazes describes the initial symptoms of small-pox and measles with care—the first vivid, lifelike description of disease occurring in medical literature after a long interval—and the therapeutic measures are undeniably the result of clinical experience. According to the case and the stage of the disease, two different courses are recommended: one consists in counteracting the intoxication by means of refrigerants and antidotal measures (cold water, mixtures containing camphor, cold spongings, affusions, baths, venesection, purgatives), the other in encouraging the outbreak of the exanthem (by means of external heat, particularly steam). The indication for one or other method lies in the height of the fever, the nature of the exanthem, the state of the pulse, the respiration or the evacuations. Detailed instructions are given concerning the methods of obviating complications and sequelæ affecting eyes, ears, nose and throat, and preventing suppuration and cicatrisation.

Rhazes takes a foremost position as a pioneer in Arabic medicine; he gathered many pupils round him, by whom he was regarded in the

light of a second Galen ; his works long remained a bountiful and popular source of medical knowledge, but in the sober, unprejudiced clinical habit of mind which led him to greatness he found few genuine disciples or followers.

Rhazes, who had a true vocation for the art of medicine, entertained a high opinion of his calling and was not blind to its limitations and deficiencies. Many of his aphorisms, rightly understood, might be taken to heart at the present day.

"Truth in medicine," he says, "is an unattainable goal, and the art as described in books is far beneath the knowledge of an experienced and thoughtful physician." The requisites for medical education which he lays down are many. He demands especially a thorough knowledge of the achievements of past times, since the scope of the art is beyond the capacities of any individual.

Rhazes is supposed to have been the author of a series of small works which may be looked upon as the apologetics of the true art and of the honourable practitioner. The following are the titles of some of these : "On the reason why slight maladies are frequently more difficult to recognise and to treat than severe ones ;" "Upon the causes which lead many people to blame an intelligent physician ;" "Upon doubtful diseases and defence of the physician ;" "Upon the fact that the capable physician is unable to cure all diseases, although praise and thanks are his due even if he fail ;" "To explain why ignorant practitioners and common women may be more successful in curing certain complaints than the better-informed physician." Rhazes describes the charlatany of the age with great insight, and in some of his writings does not hesitate at revealing certain professional abuses, striking everywhere the keynote of genuine humanity.

A lurid light is thrown upon the position of the medical profession and upon the unvarying psychology of the public in the treatise "Upon the circumstances which turn the hearts of most men from reputable physicians." The following is an extract :—

"Amongst those factors which make the people turn away from the intelligent physician and place their trust in impostors is the delusion that the physician knows everything and requires to ask no questions. If he inspects the urine or feels the pulse he is supposed to know what the patient has eaten and what he has been doing. This is lying and deception and is only brought about by trickery, by artful questions and speech, through which the senses of the public are deceived. Many hire men and women to find out all the circumstances of the patient and to report what is told them by servants, friends and neighbours. I myself, when I began to practise medicine, had resolved to ask no questions when the urine had been given me, and had been much honoured. Later, when it was seen that I made circumstantial inquiries, my reputation sank.

"Another circumstance which brings physicians into contempt is that many diseases are too little removed from the border-line of health and are thus difficult to recognise and cure ; others, malignant in themselves, externally appear trivial. When the layman sees that the physician is in doubt concerning his cure he draws it as a certain inference that the physician will understand still less of severer and more extensive illnesses. This is a false analogy. The symptoms of such diseases are less obvious because they are slighter deviations from the normal, and their cure is more difficult because no drastic remedies can be applied, but only those the effect of which is gradually brought about, such as diet, etc. An official of the hospital once complained of difficulty in moving some of his finger joints on account of a small but very hard sore which had for some time resisted the remedies he had applied. He openly reviled the physicians, saying : 'If your art does not suffice to cure a small sore on the finger, how can you treat broken ribs and arms ?' He then sought treatment from women and from the vulgar.

"But the well-trained physician is also often in doubt and may take a long time to find the proper remedy. This occurred even to Galen. Should any one object, saying, 'He, to whom this can occur, is neither wise nor quick-witted,' we should reply: 'These designations are not absolute but relative; they depend upon the advantages that the individual may have enjoyed over his contemporaries.' If it be further objected that a matter should not be entrusted to one of whom it cannot be said that he will make no mistake, we rejoin: 'Matters must be entrusted to him who is furthest from error, who errs most seldom . . . he who otherwise refuses to employ a physician would resemble him who would not ride a horse nor sleep in a canopied bed because horses stumble and the canopy might fall down—which are rare events.' . . . A physician is sometimes undervalued who takes trouble over an incurable complaint; but the imperfection of the art should be considered, in this respect unlike other arts, of which men know more than is necessary, whilst in medicine men have not yet attained to the indispensable and do not possess a remedy for every ill. The fault is therefore with the art, not with the physician. The public demands that the physician should cure in a moment, like a magician, or that he should at least employ pleasant methods, which is not at all times and in all cases possible; to blame the physician on Nature's account is a great injustice. Thus it is that sorcerers make their fortune, even though they behave iniquitously, and their incompetent work brings them a good livelihood, whilst the physician with utmost endeavour can hardly obtain the bare necessities. . . The heart of man is further turned from the capable physician and towards fools because the ignorant and women sometimes succeed in curing complaints where this has not been done by the most famous physicians. The causes are manifold, luck, opportunity, etc. Sometimes the qualified physician effects an improvement which is not, however, yet visible, the patient is then placed under another doctor who rapidly brings about a cure and obtains the entire credit. If drastic measures are employed without knowledge and they are successful, their effects are plainly visible and are considered to be the result of great dexterity. If, however, they are unsuitable they kill suddenly or lead the patient into danger. The public nevertheless applauds the sudden and visible effects and neglects those who do not adopt such measures; it talks much of the wonderful cures and forgets or conceals the failures. Many a quack is experienced in the treatment of a single complaint, or two or more, according to his practice, or because he has seen the treatment of an intelligent physician. Ignorant people, therefore, think that he has equal dexterity in everything and entrust themselves to him. It is a great mistake to think that, because he has a genuine remedy for one complaint, he has one for all. I have myself learnt remedies from women and herbalists who had no knowledge of medicine. The benefits of medicine may also be lessened through the fear that even experienced physicians have of drastic measures, whence they forsake the usual remedies and, if the patient be a king or an eminent, well-known man, suffering from a serious, hidden or doubtful complaint upon which physicians' opinions are divided, then the practitioner abandons strong remedies or even all medicine and employs foods of various kinds in order to avoid the wrath of princes or the hate of mankind. More especially does this happen if the physician have enemies or opponents among his colleagues. This circumstance brings harm to kings and princes, since they cannot make the best use of the knowledge of experienced physicians. I would therefore remark that it is advisable for an intelligent ruler that he should not make his physician anxious, but should cheer him, be much in his society, and should make it known that he will not be held responsible for the cure of incurable complaints nor held to account for error or misunderstanding."

The tenth century saw Arabic civilisation in its prime and its influence extended over the whole Moslem world. An age which produced such a philosopher as al-Farabi and many mathematicians, astronomers, natural

philosophers and geographers whose names have become famous, could hardly fail to make its impress upon medicine. The influence of these scholars was the more marked since many of them devoted themselves to the healing art in addition to their own particular subjects, whilst, under princely patronage, not only libraries, but new centres of learning in the shape of hospitals, sprang into being. In the populous towns considerable activity manifested itself in medical circles, technical literature multiplied greatly, having long passed from the stage of translations and commentaries to that of independent achievement (even in individual branches), whilst new results were not wanting in specialised knowledge, in dietetics and notably in *materia medica*. On the whole, however, tradition preponderated over original observation, erudition derived from the past over science eager for fresh information, whilst not seldom learning, overburdened with doctrine, exercised a deadening influence upon the zealous investigator.

In the medical literature not only Irak and Persia are represented, but also Egypt, Maghrib and Spain.

Of the greatest importance for the healing art in general was the comprehensive text-book written by the Persian Ali Abbas, the court physician of the Buwide emir Adhad ad-Daula and dedicated to this ruler under the title "*al-Maliki*" (the *Kingly Book*). This was intended, as the author himself says, to occupy a position midway between the too voluminous "*Continens*" and the concise "*Liber ad Mansorem*" of Rhazes. It is distinguished by lucid, systematic description and gives a complete picture of contemporary knowledge. Ali Abbas, however, gives wider scope to theory than Rhazes, although not a few extracts from his handbook indicate the fact that he took his stand upon personal clinical experience as well as upon the literature, and had upon occasion the courage to forsake authority and formulate independent opinions. He was emphatic in his recommendation to young physicians to frequent the hospitals for instruction. He attained greatest distinction in dietetics and *materia medica*.

The credit of having introduced scientific medicine into North Africa belongs largely to Ishak ben Amran. The Jewish physician Isaac Judæus, who practised first in Egypt, later in Kairwan, bequeathed writings amongst others upon diet, fever and the urine, which acquired a high reputation and later exercised no little influence upon mediæval western medicine. His pupil Ibn al-Jezzar was the author of an often-mentioned "*Itinerary for the poor*."

To Isaac Judæus is ascribed a deontological treatise, "*Guide to Physicians*," which throws many interesting side-lights upon medical conditions and contains views which even now

command respect. "He whose business it is to bore pearls," it says, "must do his work carefully in order not to mar its beauty by haste. Even so he who undertakes the cure of human bodies, the noblest creations on earth, should take thought upon the diseases with which he comes in contact and give his directions after careful reflection, so that he fall into no irremediable error.—The chief task of the physician is to prevent disease.—The majority of diseases are cured by nature.—If thou hast the choice to effect cure by nourishment or by drugs, choose the former.—Never employ more than one drug at a time.—It is in keeping with the character of the physician that he should, in his mode of life, be content with well-prepared food in moderation and be no rioter or glutton. Also it is a shame that he should suffer from a long drawn out disease, else the vulgar will say: 'If he cannot cure himself, how can he cure others?'—Let not thy mouth condemn, if an accusation be made against a physician, for to every man comes his hour. Let thy deeds be thy praise, rather than find honour in another's shame.—Comfort and soothe the patient, even if thou art in doubt, for by that means dost thou support nature.—If the patient does not follow thy directions, or if his servants and household do not carry out thy orders with dispatch or treat thee with respect, relinquish the treatment.—Demand thy fee of the patient when his illness is increasing or at its height; when he is healed he forgets what thou hast done for him.—The more thou demandest for thy treatment, the more highly thou esteemest thy cure, the higher wilt thou stand in the eyes of the people. Thy art will be held of no account only by those whom thou treatest gratuitously.—Visit not the patient too often, nor remain too long with him, unless the treatment demand it, for it is only the fresh encounter which gives pleasure."

In comparison with the height of civilisation to which Moorish Spain had attained in the tenth century the number of medical authors of real importance belonging to this epoch is small. It is a striking fact—and possibly not unconnected with the temperate attitude of philosophy—that, in contrast with the East, medical speculation expending itself upon generalities was less pursued, whilst on the contrary, special subjects were industriously studied, as, for instance, medical botany and pharmacy, in which the commentator of Dioscurides, Ibn Joljol, acquired great fame. The greatest Arabic writer upon surgery, Abulkasim, also came from Spain.

The surgery of Abulkasim formed only a part of his great general work upon medicine, "al-Tasrif," and derived its inspiration largely from the past, particularly from Paulos; nevertheless numerous personal observations and critical digressions afford internal evidence of the fact that the author was a busy practitioner of surgery, whose endeavour it was to infuse fresh life into this decadent branch of the healing art, and to bring to remembrance and fruition the almost forgotten achievements of the Greek masters. Pictures of surgical instruments accompanying the work were intended to serve the purpose of instruction. Abulkasim did not meet his due meed of success amongst his countrymen; the existing handbooks of medicine were sufficient for their scanty needs, although these dealt with surgery in a disproportionately inadequate manner. It was not until a later date that western Christendom bestowed well-deserved, sympathetic recognition upon the endeavours of the Cordovan, whereby his name and fame

were preserved throughout the centuries and placed on a level with those of Celsus and Paulos. The work of Abulkasim was early translated into Latin and by its method and lucidity awakened a prepossession in favour of Arabic literature in general. It constitutes the chief source of our knowledge upon Arabic surgery and many allied subjects.

The pride of place must, however, be given to another—to Avicenna—who in his labours was the most perfect embodiment of the essential characteristics of Arabic medicine—the assimilation of vicarious experience and the systematisation of empirical knowledge. His monumental figure stands out at the end of the tenth century, serving as an example and guide for a space of five hundred years, not only to the coming epoch and to Arabic civilisation, but to medicine in general, eclipsing all predecessors, including even Galen.

Avicenna, born A.D. 980 in Khorassan, was brought as a child to Bokhara, where his father was a high official. He early showed his great ability, knowing the Koran by heart at ten years of age, and his various teachers had difficulty in slaking his thirst for knowledge. As a youth of seventeen he was called into consultation in the case of the emir Nuch ben Mansur, and the successful issue of the treatment recommended placed at his disposal the emir's library, greatly to the advantage of his later studies. After the death of his father, who left him well provided for, Avicenna began a life of unsettled wandering, passing many years at the courts of various Persian dynasties as statesman, physician, astronomer, teacher and author, being finally appointed vizier in Hamadan. In spite of the duties of his office, he found time, even here, for the exercise of his activities in the pursuit of science, although he did not escape being involved in political intrigues which, for the time, imperilled both his position and his life. Falling under suspicion of treason, he was imprisoned, but escaped to Ispahan, where he was received with honour and where he spent fourteen years as investigator and author, particularly in the preparation of his medical and philosophical masterpiece. Excessive mental exertion and dissipation in *baccho et venere* undermined a life full both of work and pleasure, but which showed great eccentricity in both. In his enervated condition a colic rapidly ended his life in his fifty-eighth year, whilst he was accompanying his ruler upon a campaign against Hamadan.¹ Avicenna's grave is pointed out to this day.

Avicenna is supposed to have written 105 works upon a great variety of subjects in Arabic and Persian, in prose and verse; of the legal, mathematical and astronomical only the titles are known; of the philosophical only fragments, though of great importance, have survived in Latin translations; of the medical, the collection of his original observations intended as an appendix to the theoretical works, was unfortunately lost even before publication.

His fruitful labours were carried on, not in peaceful quiet, but amidst the turmoil of a strenuous life, of which every moment not given up to pleasure was utilised. By day Avicenna attended to business of state, or was occupied in teaching, the evenings were devoted to the social pleasures of friendship or of love, and many a night found the tireless author at work with his quill in hand and his goblet at his side. Upon journeys he wrote extracts and small pamphlets; whilst in captivity, poetry and mystical meditations; when he had the necessary

¹ His death is stated to have been hastened by his unsuccessful treatment of himself. Hence an Arab poet says maliciously of Avicenna that his philosophy did not teach him morality, nor his art enable him to maintain health and life.

leisure he worked at his "Canons of Medicine" or at his philosophical encyclopædia. Avicenna's philosophy is mainly Aristotelian and aims at establishing, by way of rationalism, a reconciliation between knowledge and belief. In the East Avicenna took his place as the foremost of philosophers and holds it to the present day, although at first a strong reaction against his rationalism made itself felt from the side of theology and philosophical mysticism. In the memory of mankind at large he lives as the chief representative of Arabic medicine.

The exceptionally and indeed exaggeratedly high esteem in which Avicenna was held by his contemporaries and successors rests neither upon epoch-making discoveries nor upon practical achievements bringing any far-reaching results in their train. It is rather founded upon the fact that, with a happy knack of assimilation and wonderful talent for organisation, he gave expression to the quintessence of Græco-Arabic medicine in a comprehensive, self-contained system, and thereby established medical thought and action upon foundations apparently immutable.

This system is contained in Avicenna's *magnum opus* in five parts, the "Kanun" (Canon), the claim of which—to be the code of medicine—appears in its title. In close adherence to Aristotelian principles it is, to the smallest details, an exposition of Galenism, the content of which, with all the additions which had accrued through the lapse of time, was most intelligently employed. The immense success and lasting influence of the "Canon," which at once overshadowed the "Hawi" of Rhazes, the "Kingly Book" of Ali Abbas, almost even the Galenic writings, depended chiefly upon points of form, the sparkling, lucid diction, the exemplary, comprehensive, profound, yet always clear arrangement and the logical sequence. What Rhazes presents as an enormous but unanalysed inventory, what Ali Abbas lacks, not indeed in comprehensiveness and systematic arrangement, but in completely established theory, becomes with Avicenna an harmonious whole, as though cast in one piece, accessible to the reader in a single work, not, as with Galen, laboriously to be gleaned from numerous discursive writings. The "Canon" stands for the epitome of all precedent development, the final codification of all Græco-Arabic medicine. It is a hierarchy of laws liberally illustrated by facts which so ingeniously rule and are subject to one another, stay and uphold one another, that admiration is compelled for the sagacity of the great organiser who, with unparalleled power of systematisation, collecting his material from all sources, constructed so imposing an edifice of fallacy. Avicenna, according to his lights, imparted to contemporary medical science the appearance of almost mathematical accuracy, whilst the art of therapeutics, although empiricism did not wholly lack recognition, was deduced as a

logical sequence from theoretical (Galenic and Aristotelian) premises. Is it, therefore, matter for surprise that the majority of investigators and practitioners should have fallen under the spell of this consummation of formalism, and should have regarded the "Canon" as an infallible oracle, the more so in that the logical construction was impeccable and the premises, in the light of contemporary conceptions, passed for incontrovertible axioms? This masterpiece of medical syllogism, the "Canon," which in a period of greater intellectual activity would have attracted little attention, became a landmark in the history of the art.

Impartial clinical observation, inaugurated in so splendid a manner by Rhazes, could have escaped the ban under which Avicenna had placed it and have found a fresh outlet, if the obscuring influence emanating from the "Canon" had not awakened a confidence in error, hardly comprehensible at the present day, and had not accustomed the overwhelming majority of physicians to view the occurrences at the bedside only in the light of preconceived theories, not to question Nature, but arbitrarily to construe her phenomena.

It would, however, be premature to identify Avicenna once for all with his followers, for the "Canon," judged according to its actual contents, gives many proofs of real insight, contains excellent clinical descriptions (particularly of cutaneous, nervous and venereal disorders) and admirable dietetic and therapeutic directions, the latter being prescribed with exaggerated care. A praiseworthy feature, too, is the disapproval expressed of astrology. And if this sum total hardly equals the achievements of Ali Abbas, to say nothing of the clinical pre-eminence of Rhazes, it must not be forgotten that the writing which would have given the actual measure of Avicenna as a practitioner has been lost to posterity, *i.e.*, his original records, intended as an appendix to his system.

The powerful influence of Avicenna upon the evolution of medicine was undoubtedly dependent upon the triumph of the tendency of the Arabic schools, at any rate of those in the East, to bestow interest upon individual phenomena only in so far as they could be brought into line with traditional principles and, on the other hand, to neglect the study of concrete phenomena as such.

Further, the "Canon" not only acted as a deterrent upon unprejudiced clinical observation and individual research, but also upon the study of ancient literature, having, as the epitome of the most advanced science, rendered this superfluous. Thus in course of time the summit of attainment came to consist in compilation from and commentary upon the works of Avicenna, who at bottom, in spite of the deceptive glamour surround-

ing his name, was himself nothing but a brilliant commentator, a highly endowed compiler.

After Avicenna's time no great advance was made on the whole in the East, although in the eleventh century and later there arose many excellent workers upon special subjects.

Of exceptional importance were the writings on ophthalmology of Ali ben Isa (Jesu Haly) and 'Ammar ben Ali al-Mausili, the synoptic tables of Ibn Botlan upon dietetics, and of Ibn Jezlar upon nosology and therapeutics, the commentary of Ali ben Ridhwan (Ali Rodoam) upon Galen's "*Ars Parva*," the *materia medica* ("*Liber de medicamentibus simplicibus*") of Serapion the younger. It is doubtful if the pharmacological and pharmaceutical works of "Messua" the younger are to be included in Arabic literature: they are extant only in Latin and it is supposed that under the name of "Messua" is masquerading a Latin author of the eleventh or twelfth century who hoped thus to obtain more ready recognition for his works. Nevertheless they bear the imprint of the Arabic era and, particularly the "*Antidotarium*" (known as *Grabadin*), were the means of familiarising the West with Arabic pharmacy and therapeutics.

An appendix, in Latin translation, is usually attached to the editions of Messua's works in the shape of an extract from those of Ibn Wafid (Abenguefit) upon simple remedies: this eminent physician of Toledo well exemplifies the tendency of the Islamic West to come more into line with actuality.

In the twelfth century—in the era of the Crusades and of the dominion of the Seljukians—Arabic medicine in the East entered into the period of its decline, although the literary output long remained a rich and varied one. The old centres, indeed, Bagdad, Damascus, Cairo, Bokhara, Samarcand, and others, maintained their position, powerful impulses were constantly given to medical science by the foundation of hospitals, libraries and schools, but, apart from many carefully fostered specialities, barren erudition had taken the place of original endeavour, routine that of clinical experience. It is noteworthy that, under princely favour (of Nureddin and Saladin), the medical schools of Cairo and Damascus came more and more to the front, and now, as in the earliest days of Arabic civilisation, Christians and Jews acquired the greatest name as prominent medical writers and practitioners.

Far greater strides were made in the twelfth century by Arabic medicine in Moorish Spain, where, in spite of disadvantageous political conditions (under the dominion of Almoravides and Almohades), many of the seeds

sown in the past came to fruition, and strongly marked characteristics were developed, contrasting sharply with those displayed in the East. Just as occidental Moslem philosophic thought was already imbued with the first breath of that free spirit which was later to sweep over the whole of Western Europe,¹ so did Hispano-Arabic medicine, at least as it took shape in the hands of its worthiest representatives, manifest a certain leaning towards scientific research, a notable tendency in favour of open-minded clinical observation, hand in hand with sceptical rejection of unverified tradition.

A particularly successful follower in the footsteps of Joljol and Ibn-Wafid at this period was al-Gafiki, who considerably advanced *materia medica* by means of excellent botanical descriptions, exceeding the knowledge of the ancients, whilst clinical efficiency was embodied in the family of Ibn-Zohr, from which sprang many eminent physicians during the eleventh, twelfth and thirteenth centuries, among them being the most brilliant representative of Hispano-Arabic medicine, Abu Merwan Ibn Zohr (Avenzoar).

Avenzoar was born in the neighbourhood of Seville and belonged to a highly esteemed family which settled in Spain at the commencement of the tenth century and reckoned among its members statesmen, lawyers and doctors. Avenzoar's grandfather and father attained great fame as physicians: of the latter it is reported that he held Avicenna's Canon in small esteem and that he made use of the blank margin of his copy of this work to write prescriptions on. Admirably equipped by nature and carefully educated, Avenzoar soon developed into an excellent practitioner and acquired great celebrity. He was employed at court and had honours and gifts showered upon him; he died full of years in 1162. One circumstance was, from the first, favourable to him. Imbued through ancient family tradition with the spirit of medicine, and commencing practice only after many years of the most thorough education, he dedicated all his considerable abilities to the healing art and, renouncing encyclopædic polyhistory and polygraphy, determined to be a physician pure and simple, in which endeavour he was inspired by the highest ideals.

Avenzoar, who is named in the same breath with the three great Perso-Arabians, has most in common with the greatest of the three, the clinician Rhazes. Like the latter he sees the source of advance in medical science

¹ Philosophy was comparatively late in development in Moorish Spain at a date when mathematics, natural science, medicine, geography and history had already been diligently studied. Since in the West the numerous ancient strata and divisions in matters of culture, with their divergent tendencies, were wanting, there was no need, as in the East, of the finely graded attempts at reconciliation between science and belief, whilst orthodoxy reigned undisturbed by dialectics. The very existence, however, of these simpler conditions made it inevitable that the contrast between exceptional and original thinkers and the credulous masses should be more marked here than elsewhere. It is thus comprehensible that it should have been at this period of high intellectual pressure, in the age of the Almoravides and the Almohades, if in secret and born of a few enthusiastic disciples, that the movement began which culminated in the, theologically speaking, irreligion of Averroism.

to lie not in dialectical elaborations and theorems but in careful observation of disease, and he may be said to stand out as an exception among the medical authors of the Arabic era on account of the surprising freedom and decision with which he inveighs against medical sophistry, doctrinairism and adherence to authority.

In his writings, particularly in his *magnum opus* "al-Teisir" (alleviation by means of remedies), replete with interesting clinical reports, we see the physician *κατ' ἐξοχήν*, inspired by healthy realism, scorning the tinselled glitter of pseudo-philosophy, finding satisfaction in rational practice, full of reverence for his predecessors, but admitting no master save his own observation and a judgment based upon independent experience. The contents of the "al-Teisir" display a considerable addition to nosological information (*e.g.* upon mediastinitis, pericarditis, paralysis of the pharynx, intestinal phthisis, scabies); the sober description of actual findings, the actual picture of symptom-complexes, the avoidance of anything in the way of preconceived theories, all strike a sympathetic chord. Certain of Avenzoar's statements indicate an anatomical trend of thought derived, indeed, so far as internal affections are concerned, mainly from hypothesis, but in surgical matters from immediate observation (Avenzoar explicitly states that he made a study of osteological preparations). He expresses himself, in particular, upon the indication for and technique of certain surgical operations with a thoroughness and certainty which could only have been acquired through practical experience, whilst his therapeutic recommendations bespeak an excellent acquaintance with pharmacy.¹

The circumstances of his day explain the fact that Avenzoar was, upon the whole, a disciple of Galen, although not without occasional differences of opinion in practical and even in theoretical matters; also that, in spite of a predilection for rational methods of treatment, he occasionally found himself in the deep waters of crude empiricism. He set his face rigidly against astrology. Taken on the whole, his memory remains that of a truly great practitioner, whose voice fell upon the deaf ears of his contemporaries and successors, but whose achievements heralded a new era of medicine free from subservience to authority.

A less favourable verdict from a medical standpoint must be passed upon the great contemporary, follower and friend of Avenzoar, the philosopher Averroes, who exercised so potent an influence upon the intellectual

¹ Prejudice forbade many eminent physicians to demean themselves by undertaking manual tasks connected with surgery and pharmacy. Avenzoar, however, as he himself says, had in his student-days acquired much valuable knowledge in both subjects. Lithotomy alone he declined to undertake on the ground of decency (exposure of the genitals).

development of the West, whose medical masterpiece the "Colliget" (Kitab al Kullijat, *i.e.*, Book of the General Principles of Medicine) possessed in the Middle Ages almost as much authority as the "Canon."

Averroes (Ibn Roshd) was born in 1126 at Cordova, where his father and grandfather were judges. Following the tradition of his family he devoted himself to the law but also pursued studies in mathematics, philosophy and medicine. He was Cadi in Seville, later in his native town, and acquired an extraordinary fame. The ruler of Morocco and Andalusia, al-Mansur, held him in such great esteem on account of his astonishing erudition associated with rare strength of character that in 1196 he appointed him governor of Andalusia. He did not, however, hold this honour long, for his enemies accused him of heresy and succeeded in obtaining his condemnation, expulsion from the community of true believers and banishment to an-Nisaba, a place near Cordova inhabited only by Jews. In 1198 Averroes, on the representation of highly placed friends who demonstrated the injustice of the accusations against him, was recalled and sent by the successor of al-Mansur to Morocco, where he shortly died. The whole life of this extraordinary man was taken up by the most strenuous exertion—two nights only did he spend without working, that of his wedding-day and that following his father's death. His numerous and highly important works dealt with philosophy, philology, jurisprudence, astronomy and medicine. The philosopher exercised less influence upon his countrymen than upon the West, and this was exerted chiefly through his celebrated commentaries upon Aristotle, for whom he entertained an unbounded admiration and whom he held to be the whole source of truth. These commentaries, which in the Middle Ages earned for Averroes the honourable title of "The commentator," were intended to restore the pure original significance of the Aristotelian writings, but did not completely fulfil their purpose, and from the mixture of peripatetic, neo-Platonic and oriental conceptions arose that form of pantheism known as Averroism.

The "Colliget," covering an immense field and consisting of seven chief parts, contains a complete system of medicine, built up on strictly logical lines; it betrays extraordinarily wide reading, a great gift for adaptation and a mastery of dialectics, but it is less the work of a physician than the *tour de force* of a philosopher who set himself the task of shackling the art of medicine with the fetters of peripatetic philosophy. This purpose is shown in the title and in the opening sentences of the "Colliget"; Averroes, as he admits, appealed only to those readers who are already initiated into the mysteries of natural philosophy and dialectics, to others the book would be incomprehensible. In this exposition, which outvies Avicenna,¹ and follows out rationalism to its extreme conclusions, medicine is made to appear as the mechanical application of immutable general principles and even though, under stress of therapeutic necessity, appeal has in individual cases to be made to experience, yet vicarious and occasionally personal observation are adduced mainly to lend strength and colour to the fabric woven of abstract ideas.

¹ The "Colliget" is, as it were, a colossal commentary upon the first book of the "Canon," and Averroes also commentated Avicenna's "Canticum," which he declared to be the best introduction to medicine.

The "Colliget" presents little that is new ; the practical contents may be looked upon as the ripe fruit of the author's reading ; his life indeed being little adapted to the acquirement of individual medical experience. In his fanatical adherence to Aristotelianism he is guilty here and there, in his judgment upon facts, real or ostensible, of ridiculous extravagances. In theory Averroes puts even Avicenna in the shade by a yet more logical application of Aristotelian principles.

Averroes merely bolstered up discredited theories, and certainly did nothing to advance the practical art of healing, but, apart from the enlightening influence of his philosophy, there lay concealed in his system of medicine that which was at another time to become a factor of the greatest moment in the transformation of the art. As a follower of Aristotle, who asserted the doctrines of his deified master upon all occasions, he took up the cudgels in the debatable land between the Stagirite and the Pergamene, where no unanimity reigned, always in defence of the former, whereby he shook to no slight extent the foundations of the Galenic doctrinal edifice. In direct continuity or following the example given, others have since trod the path which, seemingly leading back to Aristotle, was actually leading forwards to nature.

From the point of view of origin and education the famous Jewish philosopher, religious teacher and physician Maimonides (" Rabbi Moses ") belongs to the intellectual life of Moorish Spain, although Egypt was the sphere of his activities.

Moses ben Maimon was born in Cordova in 1135 and received a most careful education, which did not stop short at the science of Judaism but included mathematics, astronomy, philosophy and medicine. Driven out of Andalusia by the religious persecution of the Almohades he and his father found asylum for some years in Fez (1159) ; after a journey through Acre and Jerusalem (1165) he settled permanently in Cairo.¹ In Egypt he acquired exceptional renown on account of his eminent learning and his much sought after medical skill. This found recognition in his appointment as physician to the vizier al Fahdil and to the sons of Saladin. Highly gifted and endowed with inexhaustible powers of work Maimonides amassed an exceptional knowledge of the scientific literature of all branches, particularly of Greek (Aristotelian) philosophy, proof of which is furnished in his fruitful and many-sided literary activity. As a religious teacher he wrought indefatigably to bring the foundations of belief into harmony with the dictates of reason ; an attempt which is best seen in his celebrated " Guide to the Perplexed " (esteemed even by Christian theologians). Although meeting with bitterest opposition in his earliest days his rationalistic tendency, in close consonance with that of Aristotle, later became of the greatest significance in the development of Judaism. Maimonides died in 1204.

In his medical works, of which the "Aphorisms," the writing upon poisons and the Dietetic Epistle were much prized in the West, Maimonides shows himself an erudite and experienced physician, wholly free from mysticism,

¹ Expelled by the fanaticism of the Almohades other Jewish physicians from Andalusia were also attracted to Egypt, where at the time of Saladin they played an important part.

a soberly observant clinician who displayed in his therapeutics a decided preference for dietetic and expectant modes of treatment. He materially improved the method of circumcision. In matters of theory he remained faithful to Galenism, but his intimate knowledge of its doctrines led him upon occasion to criticise the Pergamene.

The list of Arabic physicians of more than local importance closes in the thirteenth century with the chief representative of pharmacology—Ibn al-Baitar.

Ibn al-Baitar was a native of Malaga who, under the direction of famous teachers, devoted himself particularly to botany and enriched his technical knowledge by means of journeys which led him from North Africa, through Egypt and Syria, to Asia Minor. In Egypt, where he held the offices of court physician and later of "superintendent of physicians and botanists," he wrote a great work upon *materia medica*, which not only included the knowledge of his forerunners, but touched upon much original research and descriptions of many plants unknown to the ancients. He died in Damascus in 1248.

The subsequent fate of Arabic medicine, in which many noteworthy advances were made in the thirteenth century (pharmacology, ophthalmology), and which only fell into total stagnation in the fourteenth, is lacking in general historical interest. This holds true in spite of the fact that it outlived its great past by many centuries, that even in our day it survives in many countries (Persia, India, Turkey, Egypt, North Africa)—but, like Chinese and Indian medicine, it exists upon the tradition of its erstwhile greatness and drags out a torpid, petrified old age.

Since the manuscripts which have been so far investigated bear only a small proportion to the extent of the original literature, and considering the possibility, by no means unprecedented, that research may bring forth surprising discoveries, it follows that we are not at present in a position to express a final opinion upon the achievements of Arabic medicine in detail. We are only familiar with its chief proclivities, and with these, strictly speaking, only in so far as they are displayed in its influence upon the art of the West, through the medium of mediæval Latin translations. Nevertheless we are able from the material at our disposal to judge of the extent to which medicine in its evolution is beholden to the Arabs.

With this reservation we may say that the Arabs imparted individuality to their legacy from the ancients by amalgamating Galenism with oriental elements, by their ingenious erection of theories, by their notable additions to empirical knowledge upon many subjects and suited it to contemporary conditions and popular customs, but that they lacked the independence to bring fruitful criticism to bear upon hereditary principles or to create

any fundamental novelty of revolutionary significance. Theirs was a strenuous activity within narrow boundaries and on conventional lines, an eager progress along a well-trodden path, but not a genuine striving after higher things.

As ætiological factors may be adduced all those conditions which exerted an unfavourable influence upon other branches of intellectual culture—inordinate belief in the infallibility of Greek tradition, predominance of dialectical methods, the intellectual disposition of the oriental, conservative submission to authority and yearning for dogmatic synthesis—whilst for medicine in particular the root of the evil is to be sought in the lack of anatomical inquiry. The most important source of knowledge was thereby choked, the chief fount of rational criticism sealed, every avenue of escape from Galenic physiology and pathology closed, and the more urgent the impulse towards ætiological investigation, the more completely did the investigator lose himself in the maze of speculation, in the wilderness of teleology, of dynamism, of the doctrine of elementary qualities, of humoral pathology.

Arabic anatomy follows almost slavishly the doctrines of Aristotle and Galen. Apart from the authority of the Greek master independent verification of facts was in this case almost entirely checked, as religious doctrines forbade the practice of dissection—isolated instances of zootomy (*e.g.* by Rhazes) or occasional investigation of human bones (Avenzoar, Abd el Letif¹) were but poor substitutes and at most could only substantiate or disprove a few of the Galenic doctrines. This by no means implies that Arabic physicians were blind to the value of anatomy, on the contrary, all the eminent authors founded their doctrines upon more or less detailed discussions, in conjunction with teleological speculations. Thus in Rhazes' handbook of medicine 26 chapters are devoted to anatomy, in that of Ali Abbas 37, in that of Averroes 37, in the "Canon" of Avicenna 95. In addition there are in Arabic literature numerous special works upon anatomy. It is a striking fact that many manuscripts are adorned with anatomical illustrations (*e.g.*, decussation of the optic nerves).

Under these conditions physiology also trod the well-worn old paths. Experimental methods, which brought forth good results in physics and chemistry, found no application in physiology. The fact hardly needs emphasising that general pathology made no advance over Galenism; it was treated speculatively as a branch of philosophy and with all the refinements of dialectics.

In reliance upon Galenism and following the example of the Syrian and Alexandrian schools, the practical branches as well as the theoretical were subjected to the tutelary influence of speculation, the utmost ingenuity being expended in order to eclipse the achievements of the past by means of meticulous pedantry and verbal quibbling. Symptomatology thus

¹ Abd el Letif (1162–1231), as the result of numerous investigations on the human skull, corrected Galen's erroneous statement that the lower jaw consisted of two separate parts joined together; he also taught that the sacrum was usually formed of one bone, not of six.

grew, founded chiefly upon a highly differentiated pulse-lore and complicated uroscopy, into a complete system, which ostensibly guaranteed exactness in diagnosis and prognosis. Therapeutics also, through anatomico-physiological fictions, and by means of the highly elaborated doctrine of elementary qualities, made pretence of being able to formulate the treatment of any individual case upon fixed principles and with almost mathematical certainty. In view of the high esteem in which astrology was held amongst the Arabs it is not to be wondered at that this pseudo-science encroached upon the domain of medicine.

Although scepticism was here and there awakened it was too weak to destroy the traditional and highly elaborated medical system, or to replace it with something better. Fortunately, however, a variety of concomitant circumstances made it possible that, despite the restrictive influences of theory, genuine observations in certain subjects and industrious compilation of the facts of trustworthy experience received due recognition, that a sphere of influence was not wanting for those investigators to whom medicine was something more than a mere appendage to philosophy, something better than the sport of ingenious conjectures. Foremost in this respect stands the noble institution of hospitals, which were made use of by the Arabs for medical investigation and instruction in addition to their own humane purposes.

The foundation of hospitals (cf. p. 348) is one of the glories of Arabic civilisation and is proof of the philanthropic spirit actuating the rulers and nobility of Islam. Foundations and bequests in the course of time made the establishment and maintenance of infirmaries possible in a number of towns, concerning which books of travel and history supply us with more or less detailed information. Thus there is record of infirmaries in Bagdad, Damascus, Antioch, Jerusalem, Mecca, Medina, Mosul, Hamar, Harran and Aleppo, in Merw, Raj, Ispahan and Shiraz, in Alexandria, Cairo, Fez, Algeciras, Cordova and other places.

As early as the ninth century there existed a hospital in Bagdad, to which were gradually added others, endowed with greater means, as, for instance, that erected in 914 by the philanthropic vizier Ali ben Issa. The largest was that founded in 977 by the Buwide Adhad Addaula. Here twenty-four physicians, some of whom were specialists, ministered to the sick, who were assembled in separate sections (for internal, surgical and ophthalmic affections); attendants undertook the preparation of the food, the administration was carried on by a superintendent who was responsible to a highly placed official (such as a Cadi). This hospital was certainly in existence as late as the thirteenth century.

In Damascus there were also several hospitals, the largest of which possessed special departments and was celebrated for such comfort that many feigned illness in order to go there; it served also as a teaching establishment and contained a voluminous medical library.

We are best informed concerning the hospitals of Egypt. The first, founded and richly endowed by Ibn Tulun, was excellently equipped, whilst we have knowledge of others in Misr (founded 597), etc. The largest and best appointed was the Mansur Hospital in Cairo, which was erected at the edict of the al-Mansur Gilafun in 1283 at an enormous expense and

which drew a large income from the landed property assigned to it. With the hospital were associated a mosque, an academy, a library and an orphanage. In the description of Makrizi it runs: "When the building was finished . . . al-Mansur caused a goblet of wine to be brought out of the hospital and drank therefrom, saying: 'I have founded this institution for my equals and for those beneath me, it is intended for rulers and subjects, for soldiers and for the emir, for great and small, freemen and slaves, men and women.' He ordered medications, physicians and everything else that could be required by any one in any form of sickness; placed male and female attendants at the disposal of patients, determined their pay, provided beds for patients and supplied them with every kind of covering that could be required in any complaint. Every class of patient was accorded separate accommodation: the four halls of the hospital were set apart for these with fever and similar complaints; one part of the building was reserved for eye-patients, one for the wounded, one for those suffering from diarrhoea, one for women; a room for convalescents was divided into two parts, one for men and one for women. Water was laid on to all these departments. One room was set apart for cooking food, preparing medicine and cooking syrups, another for the compounding of confections, balsams, eye-salves, etc. The head-physician had an apartment to himself wherein he delivered medical lectures. The number of patients was unlimited, every sick or poor person who came found admittance, nor was the duration of his stay restricted, and even those who were sick at home were supplied with every necessity." In later times this hospital was much extended and improved. The nursing was admirable and no stint was made of drugs and appliances; each patient was provided with means upon leaving so that he should not require immediately to undertake heavy work.

The Arabs in Bagdad, Cairo and Damascus had special eye hospitals and lunatic asylums. As regards the latter great credit is due to the Arabs in that the lunatics received careful and kindly attention in the asylums, not, as was so long the case in the West, being treated as criminals.

The well-equipped hospitals under purely medical supervision afforded the earliest opportunity of increasing nosological and therapeutic knowledge. That this opportunity was not neglected is proved by repeated references to the record which was kept in the infirmaries of interesting observations. Even though the fresh clinical achievements appear to be out of proportion to the number of medical authors and hospitals, yet the progress which the Arabs undoubtedly made in certain branches of special pathology and therapeutics in advance of Greek tradition are in no small measure thanks to the experience obtained in the infirmaries. The greatest strides were made in the symptomatology of nervous and skin diseases, in male venereal diseases, in epidemiology and especially in ophthalmology. Surgery, on the contrary, was in a backward condition, its advance being prevented, on the one hand through lack of anatomical foundation, on the other through the higher ethical position occupied by the physicians, and through popular sentiment; the shrinking from blood-shedding operations, which had a twofold origin, resulted in a fatal preference for the cautery or medicinal caustics over the knife. Obstetrics was in an even worse way.

The great attention paid to ophthalmology manifests itself in an extraordinarily volu-

minous literature. In addition to the very detailed descriptions in the works dealing with medicine in general, some thirty text-books or handbooks upon ophthalmology were published besides monographs. The best text-books—thirteen have survived—are those by Ali ben Isa, Hammar ben Ali al-Mausili (both in the eleventh century), Califa and Salah ad-din (both in the thirteenth century). Although the Arabic works upon ophthalmology are based upon Greek models with Indian additions, they are distinguished by great exhaustiveness and better arrangement of the subject-matter, notably too by far more accurate descriptions of operative methods. Arabic operative technique goes in many, particularly in practical, ways far beyond Greek tradition. Amongst novelties may be reckoned descriptions of hitherto unrecognised diseases, methods of examination and treatment. Special mention may be made of the description and treatment of pannus (removal of a broad strip of ocular conjunctiva around the cornea), of trachoma, elaboration of theories concerning diseases of the deeper parts of the eye (affections of the lens, of the retina, of the choroid), of the optic nerve, description of the animal parasites of the eye, of eye-diseases in children, use of the pupillary light reflex in prognosis of cataract, additions to ophthalmological remedies and improvement in methods of prescription, the minute care which was bestowed upon the preparation for performance of cataract operation (depression), finally the radical cure of cataract by suction (incision or excision of a part of the cornea and introduction of a glass tube), sclerotomy and insertion of a hollow metal needle in soft or semi-soft cataract. The ophthalmic instruments employed were many, as may be seen in the 36 illustrations to the ophthalmological work of Califa.

Surgery by no means met with its deserts at the hands of the Arabs, since the majority of the more highly educated physicians held aloof from it, and amongst the populace there was on fatalistic grounds a profound aversion from operations involving loss of blood; the performance of certain operations was also prevented through the exaggerated sense of shame of the oriental.

Abulkasim, the most famous surgical author, laments in the introduction to his special work the insufficient anatomical knowledge of his contemporaries, and illustrates the decadence of surgery by the description of a series of errors perpetrated by ignorant surgeons. Operative skill, he says, has almost entirely vanished without leaving a trace behind. Only in the writings of the ancients does one find a few references to it, but even they are nearly incomprehensible and useless through bad translation, mistakes and substitutions. Only few traces are to be seen of independent pathological observations or innovations in technique; the bulk of what is contained in the literature is borrowed from the Greeks, especially of Paulos of Aegina. Active interference was confined to a small number of operations, particularly to those in which hæmorrhage was slight and its arrest easy. The various forms of cauterising were the most general procedures.

Obstetrics fell for the greater part to the lot of the midwives, who carried out the manipulations even in abnormal cases. Physicians stood almost entirely in a purely theoretical relationship to this subject. It is noticeable that not only did the works upon general medicine include this subject in their descriptions but that monographs upon obstetrics also appeared. Arabic obstetric knowledge was based largely upon Paulos and left many important matters untouched that were contained in the older Greek authors. Care of the perinæum is forgotten, podalic version unknown. The teaching upon dystocia rests unshaken upon the old foundations, only that narrowness of the hips, but without reference to the size of the pelvis, is taken into consideration. Only head presentation is normal; all obstetric measures were undertaken with the object in view of converting other presentations, even one of both feet, into that by the head; the necessary manipulations are insufficiently described. A novelty is the employment of the fillet for extraction of the dead fœtus. Embryotomy was frequently undertaken even upon living children. Amongst the obstetric instruments, illustrations of which have survived in Abulkasim's work, are included dilators (even with screw action), hooks, etc., also forceps

with crossed handles. It cannot be definitely established that the Arabs employed forceps for the extraction of living children.

In the realms of dietetics and pharmacy Arabic medicine showed itself genuinely independent; here creative power reaped rich results and resulted in achievements which must be recognised by posterity.

The greatest influence upon dietetics, apart from Græco-Indian example, was exercised by the injunctions laid by the Koran concerning the hygienic regulation of his life upon every believer as a religious duty, and thus was evolved, amongst the most diverse sections of the people, the constant habit of paying at all times the most scrupulous attention to dietetic measures. That which held true in health and for prophylaxis was naturally applied with greater strictness to the treatment of disease and carried out for therapeutic purposes to the smallest details.¹

Dietetic therapy occupies the first place in medical text-books and constitutes a favourite subject for special treatises.

A considerable number of additions were made to the *materia medica*; the activity in commercial interchange contributed chiefly to this increase, drugs being imported from near and further India and from China; a less important part was played by the rising science of chemistry with its preparations. The Arabs sought to replace the drastics of the Greeks with mild aperients (*e.g.*, cassia, senna, tamarind), or to weaken strongly acting substances (*e.g.*, scammony) by indifferent adjuvants (violet-root, lemon-juice). Pharmacy was assiduously studied and, from the eighth century onwards, there was developed a voluminous technical literature upon medicinal botany, which derived its inspiration from the ancients, particularly Dioscurides, but which, by means of earnest original investigation, far outstripped tradition. Toxicology, as an appendage to pharmacy and under the influence of certain cultural conditions, was zealously and fruitfully studied.

The wealth of drugs and the discovery of new methods of administration (*e.g.*, syrups, julep, rob, etc.), the predilection for artificially prepared medicaments of complex nature, and the higher development of pharmaceutical technique (systematic use of distillation) necessitated a division of labour which resulted in the formation of a separate class of apothecaries and in the establishment of public pharmacies. It is probable that the

¹ Here let it be remarked that physicians in their dietetic prescriptions did not always adhere strictly to the ritual law, a fact which held particularly true of wine drinking. Thus Abulkasim and Avicenna ordered wine as a potent remedy. The strict Moslem who copied the Oxford codex of Abulkasim added the words: "Allah has forbidden wine. If it be granted to the sick man to recover he will do so without wine." It is also an interesting fact that Isaac Judæus recommended pork as a most wholesome food.

apothecaries were placed under governmental supervision and were obliged to work on the lines of officially authorised antidotaria (*i.e.* dispensaries).

The craft of the apothecaries sprang from that of the dealers in spices, as is indicated by their original designation of "Sandalani" (sandal-wood merchants). The apothecaries enjoyed no little esteem among the Arabs—in contrast with the pharmacopolists of Greece and Rome—a position they owed to the progress of pharmaceutical technique, which they raised far beyond the level of mere trade in drugs. The first public pharmacy in Bagdad was founded in the time of al-Mansur. It appears that inspections were customary and military pharmacies were provided for sick soldiers. The infirmaries had dispensaries attached to them.

A retrospective survey of Arabic civilisation leaves it an open question whether medicine shows as marked a progress as the other sciences or whether it fell behind; from a didactic standpoint, however, unanimous recognition must be accorded to the manner in which inherited and acquired knowledge was transformed into readily available, easily reviewed matter for instruction. The Arabs brought order and illumination into ancient traditions, often but dimly comprehended or existing only in fragments. In place of the mechanical extracts, the unintelligent compilations, the bewildering collations of the Byzantines they produced genuinely comprehensive handbooks consistently planned, organically uniting all the special branches; they understood how to supply the needs of students in many ways (by compendia, tables, didactic poems, etc.), and evolved a scientific terminology from their own mother-tongue—not from a long dead idiom.

Medical teaching was carefully supervised in keeping with the high standard of general education, though self-instruction in the East was forbidden; whilst the academies laid chief stress upon theory, the hospitals which fulfilled the function of educational establishments (with their special departments and ambulatories) provided mostly for practical instruction. It is a significant fact that an examination system was developed amongst the Arabs, whereby it was sought to make the practice of medicine dependent upon a proof of capacity—an institution which might well have led to an improvement in professional standing. Unfortunately it would seem not to have been permanently and universally insisted upon.¹

¹ The following bears out the above statement: "In the year 319 it came to the ears of the Calif al-Muktadir that a physician had been guilty of a professional error, whereby a man had come to his death. He therefore ordered the chief of the police to forbid all physicians to practise their art lest they should not have been examined by Sinan ben Tabit ben Kurra and have been given a diploma by him, and he ordered Sinan to examine them and give to each a permit to practise that part of the medical profession that he understood. And their number on both sides of Bagdad was 860, apart from those whose fame excused them from examination and those who

In addition to the prevalent custom of private tuition of pupils by experienced physicians those academies of medicine that were associated with hospitals were of the greatest importance for professional education. The foundations of medical teaching were lectures and interpretations of chosen Greek or Byzantine authors, to which were added disputations, which played an important part; practical dexterity in diagnosis, prognosis (particularly examination of the pulse and uroscopy), in preparation of drugs and therapeutics, could be obtained in the infirmaries under the guidance of the hospital physicians who were also teachers. Following the example of the Nestorian and Jewish schools the custom gradually arose for the students to furnish evidence of having attended the lectures and obtain written permission to undertake teaching on their own account. The medical schools of the Arabs were open to Jews and Christians also, and in teaching differences of belief were not insuperable obstacles even in the less tolerant conditions of later times.

Mention is occasionally made of a qualification for medical practice in the form of an official examination, but it is uncertain whether this institution, meant to check the mischief of charlatanry, was a permanent or merely a temporary one; there is evidence to show that under certain circumstances the regulations were not very rigidly enforced. The office of examiner was held by the "overseers" of the physicians, to whom fell the supervision of the medical profession as a whole. Although licences were not permanently and completely revoked, doubtless conditions adjusted themselves automatically in that by degrees only those physicians obtained repute and practice whose education had been conducted by recognised teachers.

At court, as amongst the people, the physician was the chief representative of learning, since the practical value of his knowledge was apparent to all. Generally speaking, physicians took high rank in social life. Particularly was this true of the influential court physicians who were not only in receipt of extravagant salaries,¹ but were in addition loaded with gifts

were in the service of the Calif. During the examination there was introduced a man, distinguished in appearance and in dress, reverend and dignified. Sinan honoured him according to his appearance, gave him a foremost place, appealed to him when anything occurred and did not cease doing so till the day's task was ended. Then only did Sinan turn to him and say: 'I should be pleased to hear something from the Sheikh, that I might take a note of and that the Sheikh should be my teacher in the art.' Thereupon the Sheikh said: 'I am not able to write or read and have never read anything, but I have a family to support and pray that thou dost not strike me off.' Then Sinan laughed and said: 'Under the condition that thou dost not turn thyself loose upon the patient with remedies thou dost not understand and dost not advise blood-letting or purgatives except for the immediate necessity of the complaint.' The Sheikh: 'That is my habit; in my whole life I have never gone beyond sugar-candy and rosewater,' and he went out. Another day a young man was brought in to Sinan, magnificent of attire, handsome of mien and intelligent. Sinan looked at him and said: 'With whom didst thou read?' He answered, 'With my father.' 'Who is thy father?' He replied: 'The Sheikh who was with thee yesterday.' Sinan said: 'A gallant Sheikh, and dost thou follow his methods?' He replied that he did. Sinan then said: 'Exceed them not, and go thou also hence.'"

¹ An example is afforded by Jabril ben Bakhtishua whose yearly income is estimated to have amounted to over £11,000. Such physicians well understood how to live in a manner in keeping with their wealth. Concerning the luxurious life of Jabril's son an eye-witness reports the following: "I visited him on an exceptionally hot day and found him in a carpeted summer-house, the domed roof of which was covered with matting and screened externally with the finest linen. He wore a heavy caftan of South Arabian silk and in addition was wrapped in a mantle. I was astonished at this attire in such heat, but I had hardly taken a seat when I noticed a striking cold. He laughed, had a caftan and mantle brought me and ordered a servant to remove the tapestry from the wall. Then I saw for the first time that there were openings in the wall leading to a hollow space which was filled with snow, and servants were continually employed driving the cool air which accumulated there into the room with large fans. A meal was now brought and the table

and honours. Successful cures were generously rewarded by the rich and it would appear that the amount of payment was a matter for agreement before or after treatment. That physicians not seldom had, on the other hand, to complain of ingratitude, and that the brilliant lot of a chosen few affords no criterion of the material situation of the great mass of practitioners, is evidenced in the utterances of Rhazes and Isaac Judæus (p. 363 and p. 365). Amongst the considerable number of doctors in the large towns the competition was very keen, the more so in that crude empirics and charlatans, despite all opposition, plied their nefarious trade; under such circumstances it is only too easy to comprehend that professional relationships and medical ethics left much to be desired.¹

It is probable that physicians were united in colleges and guilds; specialisation was rife, although its representatives were by no means always scientifically trained practitioners, partly from the fact that the well educated generally held themselves aloof from the surgical branches, abandoning these to the empirics. The eye specialists, however, formed a corporation apart. It is noteworthy that individual families (*e.g.*, the Bakhtishua, Kurra, Hunain, Zohr) produced throughout many generations eminent physicians, which on the one hand favoured culture, but on the other tended towards the stagnation of tradition.

The pride rooted in tradition and the enthusiasm for medical science of the Arab physicians found their loftiest expression in the study of medical history, the summit of attainment in which subject was reached by a physician of the thirteenth century, Ibn Abu Useiba. His "Sources of Information upon Different Classes of Physicians," from the commencement of the art to the author's time, affords the surest foundation for the later descriptions of Arabic medicine.

Arabic medicine is not to be gauged by the same measure as Greek, for its brilliance was for the most part reflected from the setting sun of vanished generations. Incapable of bringing to fruition the germ of a regenerative process which was undoubtedly inherent in it, it was essentially an edifice which included the ruins of the past in architectonic beauty, an edifice, moreover, which for centuries to come offered an asylum to medical science.

In the persons of Arabic physicians the East was once again the teacher of the West. Grateful for all they owed to the Nestorians the Moslems gladly threw open to the Christians of the West the portals of scientific medicine and granted them access to the intellectual treasures of

covered with the costliest foods. . . ." Another time the same person visited him on a cold winter's day and found him in a conservatory as in a garden. Before him was a silver brazier which was kept glowing with aromatic woods. The visitor expressing his astonishment at the pleasant warmth, the host caused the tapestries to be removed from the walls, whereupon it could be seen that slaves were employed keeping up fires whose warmth filled the room.

¹ The fact should not be overlooked that with the public at large the crudely empirical and superstitious practices of the native physicians, as well as magical and theurgical methods, enjoyed a large following. The most interesting of the varieties of medical superstition is the belief in the healing virtues of stones—in the form of amulets. The mineralogical literature dealt with this subject with the greatest scientific seriousness. Its origin was in an Arabic word falsely ascribed to Aristotle.

antiquity, if often in fantastic garb. This was a mission of no small importance.

It fell to the lot of new races to free their inheritance from its dross, to restore to it its original purity and form, and by their own exertions to raise it to a hitherto undreamt-of height. Arabic medicine, as a preparatory and transitory phenomenon, could not withstand the stress of the times, the scaffolding had to come down in obedience to the immutable laws of progress, but it is the task of history to accord honourable mention to the connecting links in intellectual evolution.

The history of Arabic influence upon occidental medicine and the gradually increasing reaction against Islam constitute the main content of medical history in the later Middle Ages and the commencement of modern times.

HISTORICAL SURVEY OF THE LITERATURE

IN the following list only the most important authors are considered, and particularly those whose works are available in printed translations, in Latin or in modern languages.

NINTH CENTURY AUTHORS

JAHIA BEN MASAWAH or MESSUA (the elder), a Christian physician (777-857), was a pupil of Jabril ben Bakhtishua and was appointed by him as director of the infirmary in Bagdad; he enjoyed the confidence of the Califs from Harun to Mutawakkil. Apart from his industry in translating he was the author of a number of medical writings dealing with anatomy, dietetics, pharmacy, treatment of different diseases, diseases of the eye, etc. From quotations by Rhazes we gather that he substituted mild purgatives for drastic and held small-pox to be caused by fermentations in the blood. The "Aphorismi Johannis Damasceni" are usually ascribed to him.

HUNAIN BEN ISHAK or JOHANNITIUS, a Christian physician from Hira (809-873), the most important of the medical translators, was a pupil of the above, although later they quarrelled. Thirsting for knowledge he travelled abroad in order to perfect his linguistic attainments and reappeared later as a physician in Bagdad, where he gave lectures. The Calif al-Mutawakkil, having satisfied himself by a hard test of his honesty, appointed him court physician and entrusted him with the work of translation, in which he greatly distinguished himself. He probably died from self-administered poison. Hunain wrote a number of treatises upon dietetics, baths, the pulse, the urine, pharmacy, fever, dysuria, stone, gastralgia, epilepsy, diseases of the eye, surgery and anatomy. The most widely known of his works was his introduction to Galen's "Microtechnē," "Isagoge Johanitii ad Tegni Galeni," which was early translated into Latin and served the medical universities as one of their most important text-books. The work follows the lines of the pseudo-Galenic *εἰσαγωγή* and contains a most ingenious elaboration of the fundamentals of Galenism. Hunain's work upon ophthalmology has, according to recent investigations, been preserved in two Latin translations as "Liber de oculis translatus a Demetrio" and "Liber de oculis Constantini Africani."

JAKUB BEN ISHAK AL KINDI or ALKINDUS, son of a governor of Kufa, lived in Basra, later in Bagdad, where he was held in high esteem by the Califs al-Mamun and al-Mutassim on account of his learning. He wrote at least 200 treatises upon philosophy, mathematics, astronomy, astrology, physics, etc. Of his 22 medical writings the book "De medicinarum compositarum gradibus, investigandis libellus" was the best known.

JAHIA BEN SERABI, SERAPION (the elder), a Christian physician from Damascus, compiled in the Syrian language a large work in twelve books and a smaller one in seven upon special pathology and therapeutics. The latter has been edited in Latin rendering under different titles, as *Practica*, *Breviarium*, *Therapeutice methodus*, *Aggregator*. The pathological arrange-

ment is very faulty, chief stress being laid upon formulæ. Serapion advised venesection in most inflammatory affections and gave subtle directions upon the choice of veins in its performance.

RHAZES (850-923 or 932).

ABU BEKR MOHAMMED BEN ZAKARIYA AR-RHAZI, called RHAZES, Rhasis, Abubater, Albubeter, Bubikir, etc.

Rhazes was the author of more than 200 writings, partly medical, partly philosophical, mathematico-astronomical or chemico-physical in their contents, of which the majority have been lost. Of the medical writings the following are the most important:—

“Al-Hawi” or “Continens” (Content of Medicine), a work of immense scope upon all branches of medicine, founded chiefly upon the achievements of the Greeks and of the earlier Arabic physicians.

“Kitab al tib Almansuri” — “Liber medicinalis Almansoris” — “Liber medicinæ Mansuricus.” A compendium of medicine distinguished by a terse and accessible method of presentation. It is divided into ten parts, the ninth of which, upon specialised therapeutics, was long used in the West as the foundation of academical instruction, on which account it was published separately or incorporated with other works in Latin form.

“De varoliis et morbillis,” formerly known as “Liber de pestilentia” — upon small-pox.

A few points may be mentioned from the well-stored medical works of Rhazes.

INTERNAL MEDICINE.—Essential fevers are distinguished from those that are purely symptomatic. Sweating does not indicate a real crisis, only that Nature is able vicariously to effect excretion; many irregular fevers arise from suppuration of the kidneys; treatment of fever should be according to its causation. In inflammatory fevers Rhazes recommended the use of cold water, in putrid inflammations of the chest strengthening measures and wine, in phthisis milk and sugar, in indigestion buttermilk and cold water. Jaundice he held to be caused by obstruction of the bile-passages. A noteworthy recommendation is that of chess for melancholia. The dangerous qualities of miasmata were known to him. Excessive use of purgatives was materially checked by Rhazes; in obstruction he preferred oils to quicksilver. Venesection was practised by Rhazes in the most widely different affections, but he was not lacking in care, since he took into account season, climate, age and constitution; in the case of children and old people blood-letting was to be performed only in face of the most urgent necessity.

DIETETICS AND THERAPEUTICS.—Rhazes attached high value to dietetic measures; baths and washing he naturally laid stress upon; he was, on the other hand, no friend to the production of emesis. The list of drugs is a long one. Indian materia medica is laid under contribution as well as Greek; animal and mineral substances were employed in addition to vegetable. Amongst these were: camphor, musk, amber, cardamoms, nutmeg, cashew, cassia fistula, manna, nux vomica, senna, caryophyllum, sal-ammoniac, various oils, different alcoholic drinks, arrack. As regards the exhibition of drugs, Rhazes was familiar with decoctions, infusions, powders, pills, linctus, syrups, rob for internal administration; for external, salves, liniments, plasters, cerata, suppositories, gargles, sternutatories, compresses, fumigations, clysters, collyria.

SURGERY.—In the case of penetrating abdominal wounds fomentation of the distended, prolapsed intestines with warm wine is recommended, reposition of the bowel in a warm bath, removal of the mortifying omentum after ligature of the vessels with fine thread. Amongst diseases of the skin is mentioned erysipelas, “Ignis sacer” or “Persicus.” In the treatment of viper-bite the limb should be bound tightly round above the wound, and if the

snake be of a particularly venomous species the limb should at once be amputated. A specially constructed instrument is described for removal of foreign bodies from the œsophagus. Retention of urine may be due to stone or paralysis; if medicines are unavailing recourse must be had to the catheter. The origin, symptoms and treatment of vesical calculus are very fully described in the twenty-third book of the "Continens." Tracheotomy according to Antyllos' method is described in the seventh book of the "Continens."

OBSTETRICS.—In difficult cases instruments with screw movements were employed to dilate the passages. Head presentation was held to be the only normal one, hence cephalic version had to be attempted by every possible means (including shaking) even in the case of complete foot presentation. If neither this nor extraction by the feet is possible, embryotomy is to be performed. In the case of large children assistance by pulling with the fillet is recommended.

OPHTHALMOLOGY.—In the "Continens" are found many original observations of Rhazes. For pediculosis of the lids mercurial ointment is recommended. Errors of vision, which originate in the brain, are accompanied by headache and tinnitus aurium. Amongst operations are described the removal of pannus and that for symblepharon, needling of cataract following Antyllos, evacuation of cataract by means of a glass tube, cauterisation of lachrymal fistula, etc. The ninth book of the "Liber medicinalis Almansoris" is a very pithily expressed ophthalmological work; an important statement in it is that the pupil contracts to light.

TENTH CENTURY AUTHORS

PERSIA AND IRAK

ALI IBN AL-ABBAS AL-MAJUSI (*i.e.* the magician or fire-worshipper), known as ALI ABBAS (Haly Abbas), physician to the Emir Adhad ed-Daula, dedicated to the latter his chief work "al-Malaki" or "Liber Regis." The "Kingly Book" is divided into two parts, a theoretical and a practical, each of ten books. The former deals with anatomy, physiology, dietetics, general pathology, semeiosis, special affections (*e.g.*, abscesses, skin diseases, wounds and ulcers), with internal diseases and prognosis. The practical part contains hygiene, dietetics, pharmacy, specialised pathology, therapeutics and so on. Amongst other points of interest in the contents we may note that the subject of dietetics is excellently dealt with, attention being paid to different ages, seasons, climates and habits of life; also the influence upon health of water and clothing are mentioned. Venesection was made use of by Ali Abbas in many cases, but upon children and old people only under stress of urgency; different veins were chosen according to the organ affected. Like other Arab physicians Ali Abbas extols the virtues of sugar as food for new-born infants; consumptives are recommended milk and sugar. In obstetrics emphasis is laid upon the action of the uterus in parturition, as opposed to the Hippocratic assumption of the active emergence of the child; amongst operations on the dead fetus amputation of extremities, perforation and crushing of the head and extraction by means of a hook are described.

EGYPT AND MAGHRIB

ABU JAKUB ISHAK BEN SOLIMAN AL-ISRAELI—ISAAC JUDÆUS—a Jewish physician who first practised ophthalmology in Egypt, later emigrated to Mauretania and finally became court physician in Kairwan. The writings of Isaac Judæus—notably upon diet, fever and the urine—enjoyed a great reputation and popularity in Christian Europe.

ABU JAFAR AHMED BEN IBRAHIM AL-JEZZAR (Algizar, Algazirah) of Kairwan was a pupil of Isaac Judæus. The "Guide for the Poor," ascribed to him and the source of a widely circulated mediæval work the "Viaticum," was translated into Greek, Latin and Hebrew. He was a prolific writer who, amongst other subjects, dealt with the causes of plague in Egypt.

SPAIN

ABUL KASIM BEN ABBAS AL-ZARAWI—ABULKASIM (Abulcasis, Albucasis, Bucasis, etc.). His comprehensive work upon medicine, "Altasrif," consisting of 30 parts, attained a more lasting reputation in Christian Europe than amongst the Arabs, more especially the surgical section. This is even at the present of great historical significance on account of the illustrations of instruments.

SURGERY.—This is divided into three books, apart from the index, and is mainly founded upon Paulos. The first book deals with the indications for, technique of and contra-indications against cauterisation. This was usually carried out with suitably shaped iron instruments, less often with caustics. A large number of ailments called for the performance of this operation. The last chapter is devoted to the arrest of hæmorrhage. Here also cauterisation plays an important part, but in addition other methods are described, viz., complete severance of injured arteries, ligature (tying in two places by means of double threads passed under the artery, which was lifted up with hooks), styptics and, in case of necessity, digital pressure.

In the second book, which deals exhaustively with the greater portion of surgery, the debt to Paulos, even in the arrangement, appears still more distinctly, although many original methods and observations are in evidence. He describes lithotomy in detail, also lithotripsy and circumcision; in reference to tracheotomy he remarks that he knows no one who has performed this operation. The indication for amputation was gangrene, which might arise from internal or external causes; amputation was permissible as high as the elbow- and knee-joints; if mortification extended higher, death was inevitable. Hæmorrhage during the operation was controlled either by cautery or styptics; no mention is made of ligature.

The third book contains the teaching upon fractures and dislocations. Abulkasim energetically condemns refracture of badly set bones. In the chapter upon fracture of the spine the paralytic phenomena, varying according to the seat of the lesion, are mentioned. In fracture of the pelvis in women a sheep's bladder is to be passed into the vagina and distended with air by blowing through a tube in order to assist reposition.

OBSTETRICS.—The section dealing with this subject contains directions upon the method of treatment in prolapse of a hand, in foot presentation, presentation of knees and hands, transverse position with and without prolapse of a hand. The recommendation is new that, in presentations of both feet, delivery should be effected by the breech after reposition of the feet. Abulkasim also makes mention of face presentations.

OTOLOGY.—Removal of foreign bodies should be undertaken with the aid of bright sunshine thrown into the ear, and the method adopted should bear relation to the nature of the substance which has penetrated into the meatus. There are four varieties of foreign bodies: hard substances (*e.g.* pieces of iron and glass), vegetable seeds (*e.g.* beans), fluids, and finally living animals. In the case of hard substances extraction is to be attempted by means of oily instillations, sternutatories (with simultaneous closure of the nostrils and drawing up of the auricles), suction, extraction with forceps or a probe covered with an adhesive material. If these

attempts are in vain the auricle is partly reflected and the extraction performed. A swollen foreign body of vegetable origin should first be reduced in size with a small knife. Live insects should be removed by means of oily injections or by suction.

DENTISTRY.—Extraction was only to be undertaken when every medicinal means had been tried in vain and was preceded by separation of the gums and gradual loosening with the fingers. The operation was performed by a movement in a vertical direction with a strong forceps of hardened steel and with interlocking teeth. The cavity was first plugged with linen. Irregularly developed teeth were extracted or filed down. Loose front teeth were anchored by gold or silver wire to the firm ones; missing teeth were replaced by artificial ones made of ox-bone.

AVICENNA (980-1037). **ABU ALI AL-HUSAIN BEN ABDALLAH IBN SINA.**—There are some thirty Latin editions of Avicenna's masterpiece, the "Canon," consisting of five books.

In the doctrines of the "Canon" one comes upon many ideas and observations peculiar to the author. Amongst these may be mentioned the qualities of pain, of which he distinguished fifteen, and upon which he set great value. He is also acquainted with the dissemination of disease-products by means of earth and drinking-water, distinguishes pleuritis from mediastinitis, and considers phthisis to be contagious. Particular attention is paid to skin-diseases, diseases of the male generative organs and nervous affections.

In later times chief attention has been paid to Avicenna's psychiatry, for which reason the fundamental principles of his views on this subject may be indicated. Psychic alterations depend upon pathological changes in the proportional admixture of the brain. They may be divided into elementary intellectual disturbances (of imagination, of memory) and real psychoses (melancholia, mania, weak-mindedness). Intellectual disturbances arising from black bile betray themselves through anxiety and sadness: if yellow bile is the cause, confusion, irritability and violence arise, excess of putrefying phlegm calls forth a serious and morose mood. Abnormalities of the front part of the brain cause disturbance of the perceptive power (it may be that the patient is subject to hallucinations, or that he may have an incorrect conception of things); weak-mindedness and imbecility depend upon abnormalities of the middle ventricle; failure of memory upon that of the posterior ventricles of the brain. Phrenitis—due to accumulation of yellow bile in the meninges or brain—is a mental derangement arising in acute feverish diseases, and is ushered in by forgetfulness of the immediate past and is characterised by confusion with restlessness. Lethargy—caused by intra-cranial accumulation of phlegm—manifests itself by forgetfulness with great exhaustion, moderate fever and profuse sweating. Coma vigil, *i.e.* somnolence with unconsciousness, and *vigilia veternosa*, *i.e.* light, broken sleep, are caused by accumulation of phlegm and bile; in the former case phlegm preponderates, in the latter bile. The symptoms of mania are insomnia, delirium, great unrest and violence. In a special variety of mania the patient, like some dogs, is aggressive, but at the same time cringing and submissive. In melancholy the symptoms are: sick fancies, fear and dread, inclination towards solitude, despair, palpitation of the heart, oppression in the hypochondrium, etc.; the cause being unconsumed black bile. Besides causal and symptomatic, psychic treatment was also employed, such as cheering the patient with reading and music, in obstinate cases exciting fear. A certain resemblance to melancholy is found in *amor insanus*, the diagnosis of which is made from the pulse, which betrays marked alteration on mentioning the name of the loved one. Nightmare occurs as a prodromal stage in epilepsy, apoplexy and mania.

In judging of the effect of a drug the following points should be taken into account. Firstly, that the remedy should be employed in its natural state; secondly, that the disease in which it is employed be an uncomplicated one; thirdly, that proof of the remedy be made in two opposed cases; fourthly, that the strength of the remedy be inversely proportional to the

severity of the complaint; fifthly, that the time of commencement of the action be noted; sixthly, that careful observation be made as to whether the remedy have always, or generally, the same effect; seventhly, that experiment be made upon the human body. Taste, colour, smell, etc., were supposed to afford clues as to the therapeutic effect of drugs.

In general therapeutics Avicenna's views upon venesection deserve some notice. In making use of this measure he had two purposes chiefly before him, the removal of superfluous matters and the elimination of morbid substances. Hæmorrhage also furnishes an indication (in order to divert the blood another way). Avicenna gives directions upon the choice of veins (*e.g.*, the cephalic in affections of the upper, the saphenous in those of the lower half of the body), manner of opening the vein, amount of blood to be drawn, position of the patient, and he develops fully the doctrine of indications and contra-indications. In general he recommends that venesection be undertaken upon the sound side if the result is desired only after a lapse of time and its effect is to endure for some while.

SURGERY AND OBSTETRICS.—Intubation of the larynx is hinted at; tracheotomy is described; operation for empyema with cautery or knife; operation for ascites (only in extreme urgency); treatment of piles and fistula by ligature; lithotomy, treatment of hernia by astringents and cautery. Amongst methods of arresting hæmorrhage are described ligature, tamponage and caustics. In the description of dislocations that of the coccyx and the method of reposition of the head of the humerus are included. Amongst the causes of dystocia is mentioned "small hips." To assist delivery in difficult cases are recommended drugs, vapours, baths, pressure on the abdomen, knee-elbow position, a position in accordance with the necessities of the case in order to bring the head over the os uteri. The only normal presentation was held to be that by the head; next to this was that by both feet, in which case, however, assistance was called for. To assist extraction nooses were employed as, *e.g.*, when birth offered difficulties owing to the size of the infant. Before proceeding to embryotomy an attempt should be made to procure delivery by means of forceps (which are not however further described). The manner in which this is recommended by Avicenna leaves it doubtful whether this refers to dead or living children.

ELEVENTH CENTURY AUTHORS

IRAK

ALI BEN ISA—**JESUS HALY** (in first half of eleventh century)—was the foremost Arabic ophthalmologist. His "Book of Memoranda for Eye-Doctors," consisting of three parts, is the earliest special work upon ophthalmology which has been preserved entire. After a short introduction Book I. deals with the anatomy and physiology of the eye, following Galen. Book II. contains the diseases of the eye recognisable by the senses, amongst which are included diseases of the lids, of the lachrymal apparatus, of the conjunctiva, cornea and iris. Book III. contains the eye-diseases not recognisable by the senses, such as diseases of the aqueous and vitreous humours, night-blindness, day-blindness, diseases of the lens, retina, optic nerves, etc.; upon this follow dietetic prescriptions, method of treating headache and migraine, finally an enumeration of simple ophthalmic remedies with a description of their mode of action.

EGYPT

ALI BEN RODHWAN or **RODOAM** (ca. 1068), proto-medicus of Egypt under the Calif al-Hakem, attained celebrity as a teacher, but was feared on account of his quarrelsomeness.

The most important of his writings was the commentary upon the Hippocratic and Galenic works as well as upon the "Centiloquium" of Ptolemy. The commentary upon Galen's "Microtechnē" was translated into Latin.

SPAIN

IBN WAFID EL-LAHME or ABENGUEFIT (997-1070) was a hospital physician in Toledo, and for a while vizier. He was distinguished for a rational method of treatment. His principle was so far as possible to use none but dietetic measures; if drugs were necessary he preferred simple ones to complex. The best known of his works were the "De medicamentis simplicibus" and "De balneis sermo." A conclusion may be arrived at upon the true action of a drug if the following eight conditions be observed: 1. to make sure that the drug is free from any addition; 2. the disease in which the drug is employed must be a simple one; 3. the treatment must be *ex contrario*; 4. the strength of the remedy must be proportional to the severity of the disease; 5. it must be noted whether the remedy induce cold or warmth; 6. the result must be obtainable by everybody and at all times; 7. the effect must take place upon the human body; 8. distinction must be drawn between drugs and food.

TWELFTH CENTURY AUTHORS

SPAIN

ABU BEKR MOHAMMED IBN BADJEH or AVEMPACE (ca. 1138), one of the most notable Arabic philosophers and poets, was also a physician and medical author. He lived in Saragossa, Seville, Granada and lastly at the court of the Almorawides in Fez as vizier; he is said to have been poisoned at the instigation of jealous physicians. Amongst his medical writings those upon pharmacology were the best known.

ABU MERWAN IBN ZOHR or AVENZOAR (Avenzohar, Abumeron) (ca. 1162). His most important work "el-Teisir" contains not a few interesting descriptions of diseases, which are evidences of his independent observation. Avenzoar was familiar with the noxious influence of miasmata upon health, distinguished between primary and secondary diseases of the heart, describes serous pericarditis, mediastinitis, paralysis of the pharynx, inflammation of the middle ear, etc. In his therapeutics he showed himself much averse from the use of purgatives, but on the other hand he was over-inclined to employ venesection (performing it even upon his own three-year-old son). In consumption he made use of goats' milk. In paralysis of the gullet he employed artificial feeding (pouring milk into a tube passed into the œsophagus) or nutrient enemata (the apparatus consisted of a bladder into the neck of which is fastened a silver tube), the latter after preliminary cleansing of the rectum. Tracheotomy was recommended by him in cases of threatening suffocation and he relates that he once performed the operation experimentally upon a goat.

THE EAST

ABU IMRAN MUSA BEN MAIMUN or MALMONIDES (Rabbi Moses ben Maimon) (1135-1204). The following printed translations (in Latin or modern languages) of his medical works are in existence:—Upon poisoning and its treatment. Contents: bites of poisonous animals, general and special treatment, prophylaxis in relation to internal poisoning, demeanour of the supposed or actually poisoned, antidotes. The following poisonous animals are mentioned: scorpions, spiders, bees, wasps, snakes, mad dogs, but the most dangerous bite is that of a

fasting man. The poisons named are : hyoscyamus, nightshade, poisonous fungi, cantharides, etc. In poisoned wounds the treatment applied included ligature of the bite, sucking out the poison by means of cupping glasses or with the oiled lips, keeping the wound open, as well as external (salt, onions, asafetida) and internal remedies (emetics). The most valued internal antidotes were mandragora, precious stones and various aromatics.

The "Aphorisms." These contained for the most part extracts from Galen's works and from those of other authors, as well as personal experience. In numerous places are to be found references to errors and inconsistencies on the part of Galen.

The "Treatise upon Hygiene." This consists of four books in which the mode of life in sickness and in health is laid down and hygienic rules enunciated.

Other works are "Upon the Causes of Accidents," two treatises upon coitus and the book "Sepher Rephuoth," dealing with dietetics.

THIRTEENTH CENTURY AUTHORS

ABU MOHAMMED ABDALLAH BEN AHMED IEN BAITAR.—His *materia medica* "Jami el Mufradat" or "Corpus simplicia medicamentorum et ciborum continens," is the most comprehensive botanico-pharmacological work in Arabic literature.

The whole range of *materia medica* is covered by Ibn Baitar in 2330 stanzas arranged alphabetically, wherein the work of Dioscurides, Galen and the Arabic pioneers is made use of, as well as original observations. The number of simples is about 1400, of which some 300 are new. The work is of great value from the historico-literary and philological points of view, as well as from its astonishing scientific contents.

IEN ABU USEIBIA MUWAFFIK ED-DIN (1203-1273).—A member of a medical family which devoted itself particularly to ophthalmology; he practised first in his native town of Damascus, later in Cairo as a hospital physician, and finally lived at the court of an Emir in Syria. He made great contributions to the history of medicine in his work "Sources of information concerning different classes of physicians," which provided enlightenment upon 399 physicians and investigators.

ABDUL FARAJ JORJIS, known as BAR HEBRÆUS (1226-1286), occupied himself mainly with history, philosophy, theology and grammar, but also acquired medical knowledge in the great college of Damascus; later he became a bishop and finally metropolitan of the Jacobites. He published several medical compilations and commentaries, and began a Syrian translation of Avicenna.

ABUL MUNA IEN CHAFFATS AL KUHIN (or COHEN) AL-ATTAR (the apothecary), a Jewish physician in Cairo, wrote in 1259 a work upon pharmacy, undoubtedly the best of its kind in Arabic literature, which enjoyed for centuries a corresponding renown in the East.

AUTHORS OF DOUBTFUL ORIGIN

MESSUA (the younger).—According to an unreliable account this author, known also by a variety of other names and whose works exist only in Latin translation, is supposed to have been a Jacobite Christian of the tenth century, who received his education at Bagdad and practised as court physician to the Fatimides in Egypt. It is highly probable that a Latin-writing author of the eleventh or twelfth century is masquerading under the name of Messua, thinking thus to obtain more ready acceptance of his writings. The success following

this method may be judged from the fact that "Messua's" works were printed almost as frequently as Avicenna's and were the subject of commentaries as late as the sixteenth century. Writings: "*De medicinis laxativis*," also called "*De simplicibus*" or "*Consolatio*," consisting of a general and a special part; "*Antidotarium sive Grabadin medicamentorum compositorum*."

The writing "*De consolatione medicinarum*" deals with the choice of purgatives according to their properties and actions, with the correction of the same, *i.e.*, the removal of their harmful constituents, with the eventuality that the remedy may fail of its action, and with the neutralisation of the disturbances called forth in the organism by it. Emetics are included with purgatives. The former are divided into those of mild action (*e.g.*, aniseed), those of medium strength (*e.g.*, *nux vomica*) and those drastic in their action (*e.g.*, white hellebore). Purgatives are divided into mild and drastic; to the former belong wormwood, tamarind, rhubarb, to the latter scammony and colocynth. Correction of purgatives is brought about by cooking or washing, by infusion (with water, vinegar, milk, etc.), or by pulverisation.

The "*Antidotarium*" or "*Grabadin*" contains in twelve parts directions for the preparation of drugs. This work stands as the canon of the apothecary's art in the West, and throughout the Middle Ages was held in the highest esteem. Messua was looked upon as "*pharmacopœorum evangelista*."

SERAPION (the younger).—Under this name was published a book upon simple drugs ("*Liber de simplici medicina*"), highly prized in the West in the Middle Ages and beyond them. The authorship is only a matter of conjecture; it is essentially a compilation from earlier Greek and Arabic physicians.

WORKS IN THE PERSIAN LANGUAGE

ABU MANSUR MUWAFFAK BEN ALI HARAWI was the author of a *materia medica*, the importance of which lies in the fact that not only Indian remedies, but also Indian medical principles are given prominence therein.

The work describes 585 drugs, 466 of which are of vegetable, 75 of mineral and 44 of animal origin. These are divided by Abu Mansur into four groups according to their effects upon the human body. To the first belong those which may usefully be employed externally and internally (*e.g.*, wheat, internally, as a food, externally as a dusting powder in certain skin-diseases); to the second group belong those substances which internally serve as food, but externally are irritants (*e.g.*, garlic); the third group includes those which externally have in certain cases healing properties but internally are in considerable doses poisonous (*e.g.*, copper salts); the fourth section consists of substances which both internally and externally are poisonous (*e.g.*, aconite preparations). The four qualities of the human body undergo certain changes through the influence of drugs and food. The influence is usually of the nature of a reinforcement of one of the four qualities, four degrees of effect being differentiated. The substances belonging to the first of the above-mentioned groups exert their influence in the first degree, on which account they chiefly serve the purpose of nourishment—these are specific poisons. The substances which exert their influence in the second and third degrees are partly food materials serving remedial purposes, partly actual drugs. In order to be able to distinguish accurately the slight differences which the various substances manifest in their actions three subdivisions are recognised in each degree, so that the operation of a remedy in causing cold or warmth, moisture or dryness may be at the commencement, middle or end of a degree. The poisons are divided into three classes. To the first belong animal poisons, which are only introduced into the body by a bite or sting, to the second

belong those vegetable or mineral poisons which possess an effect in small doses (*e.g.*, aconite, *secale cornutum*); the third class embraces the "slowly killing" poisons, which for the most part have a specific effect upon a special organ (*e.g.*, cantharides on the kidney, aconite on the heart). Certain symptoms furnish indications in the diagnosis of poisoning: thus heat, burning and pain in the intestinal tract, with simultaneous sweating, point to an acute intoxication (as from arsenic or mercurials), loss of consciousness, weakness and coldness of the surface, to narcotics; the smell, taste and colour of the vomit are of the utmost importance; Abu Mansur does not provide a universal antidote.

ARMENIA

MECHITHAB of Hor, "the doyen of Armenian medical authors," published in 1148 the work "Relief in Fevers." The number of varieties and subvarieties of fevers is great; the diagnosis rests upon the anamnesis and upon observation of pulse, urine, tongue, skin, excretions; in one place the percussion note of the distended abdomen and the enlargement of the spleen are mentioned.

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